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NATIONAL DAM INSPECTION PROGRAM. MIDDLE DAM (NDI-ID-PA-00256) (--ETC(U)
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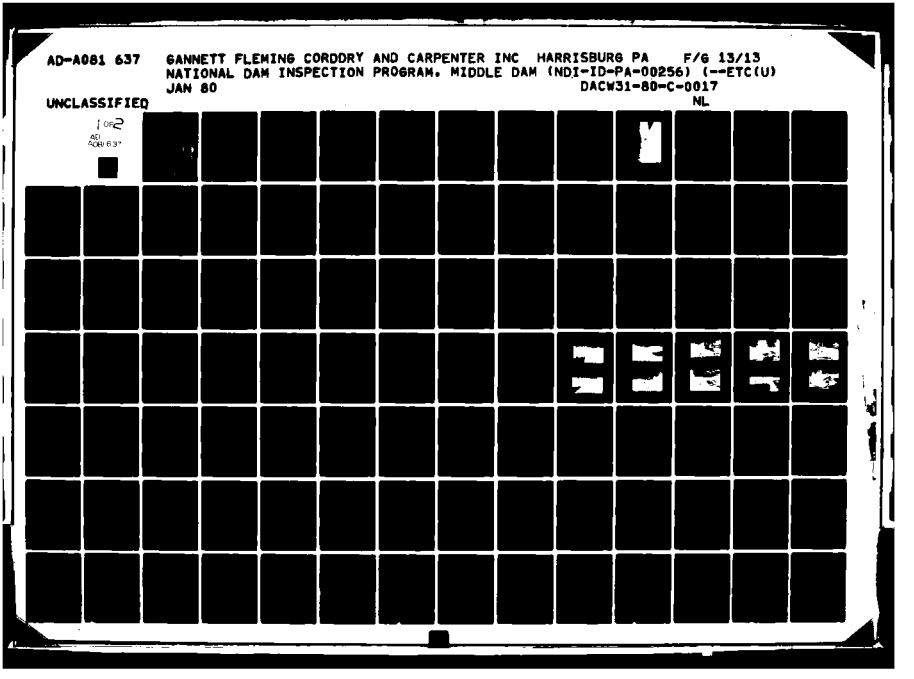

DELAWARE RIVER BASIN
SAMBO CREEK, MONROE COUNTY

PENNSYLVANIA

MIDDLE DAM

NDI ID NO. PA-00256
DER ID NO. 45-3

BOROUGH OF EAST STROUDSBURG

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE

Prepared by
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
Consulting Engineers
Harrisburg, Pennsylvania 17105

For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

JANUARY 1980

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PHASE I INSPECTION REPORT

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Prepared by

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Baltimore, Maryland 21203

JANUARY 1980

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

DELAWARE RIVER BASIN

SAMBO CREEK, MONROE COUNTY

PENNSYLVANIA

(6) National Dam Inspection Program

MIDDLE DAM

(NDI-ID No. PA-00256)

(DER-ID No. 45-3)

BOROUGH OF EAST STROUDSBURG

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

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CONTENTS

APPENDICES

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PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT OF GENERAL CONDITION

AND

RECOMMENDED ACTION

Name of Dam:	Middle Dam NDI ID No. PA-00256 DER ID No.45-3
Size:	Small (24 feet high; 197 acre-feet)
Hazard Classification:	High
Owner:	Borough of East Stroudsburg Larry Comunale, Borough Manager Box 303 East Stroudsburg, Pa. 18301
State Located:	Pennsylvania
County Located:	Monroe
Stream:	Sambo Creek
Date of Inspection:	13 November 1979

Based on visual inspection, available records, calculations, past operational performance, and according to criteria established for these studies, Middle Dam is judged to be unsafe, non-emergency because the spillway capacity is rated as seriously inadequate. Under existing conditions, the spillway can pass only about 22 percent of the Probable Maximum Flood (PMF) without overtopping of the dam. If low areas on the top of the dam were filled to the design elevation for the top of the dam, the spillway would pass about 33 percent of the PMF. For either condition, it is judged that the dam could not withstand the depth and duration of overtopping that would occur for the 1/2 PMF. Failure of the dam would cause an increased hazard for loss of life downstream. As a whole, the dam is judged to be in fair condition.

No stability problems were evident for the embankment. Stability analyses were performed for the spillway weir for this Report. The results do not deviate significantly from recommended guidelines for stability under normal loading conditions, but the results indicate that the weir might fail by over-turning under the assumed maximum loading conditions because the resultant was found to be located outside of the toe. It is noted that the analyses were based on a number of assumptions and that the results are only approximate.

There are no drawdown facilities at the dam. Water can be discharged from facilities at a treatment plant located 0.3 mile downstream, but the ability of the facilities to drawdown the reservoir is questionable.

The following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Perform additional studies to more accurately ascertain the spillway capacity required for Middle Dam as well as the nature and extent of measures required to provide adequate spillway capacity. Take appropriate action as required.

(2) Make repairs to the spillway apron. Perform additional investigations and studies to more accurately assess the stability of the spillway weir as well as the nature and extent of measures required to provide adequate factors of safety for all expected loading conditions. Take appropriate action as required.

(3) Provide properly designed facilities to collect and dispose of water along the toe of the dam and in the valve chamber. The facilities should include measurement devices. Seepage should be monitored, and records of seepage should be maintained.

(4) Perform a study to determine whether the reservoir could be drawn down over a reasonable period of time with the existing facilities at the treatment plant. Take appropriate action as required to ensure adequate drawdown facilities.

(5) Undertake remedial measures for other minor maintenance items.

All investigations, designs, and supervision of construction should be performed by a professional

engineer experienced in the design and construction of dams. The seepage monitoring program should also be performed or supervised by a professional engineer.

In addition, the Owner should institute the following operational and maintenance procedures:

(1) Develop a detailed emergency operation and warning system for Middle Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Middle Dam.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system.

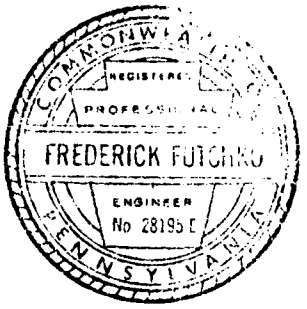
(4) Institute an inspection program such that the dam is inspected frequently. As presently required by the Commonwealth, the program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the results to determine if remedial measures are necessary.

(5) Expand the existing maintenance program so that all features of the dam are properly maintained.

MIDDLE DAM

Submitted by:

GANNETT FLEMING CORDDRY
AND CARPENTER, INC.



FREDERICK FUTCHKO
Project Manager, Dam Section

Date: 11 February 1980

Approved by:

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT, CORPS OF ENGINEERS

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 29 Feb 1980

MIDDLE DAM

Overview

DELAWARE RIVER BASIN

SAMBO CREEK, MONROE COUNTY

PENNSYLVANIA

MIDDLE DAM

NDI ID No. PA-00256
DER ID No. 45-3

BOROUGH OF EAST STROUDSBURG

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

JANUARY 1980

SECTION 1

PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Middle Dam is an embankment dam 24 feet high at its maximum section and 634 feet long, including the spillway. The dam has a stone masonry corewall with earthfill upstream and earthfill and rockfill downstream.

The spillway is located near the right abutment of the dam. The spillway weir is concrete that was placed over stone masonry. The structure is 42 feet long, but

a 2-foot wide pier at the center reduces the effective crest length to 40 feet. A concrete apron is located at the toe of the weir. The outlet channel is rectangular and is lined with stone.

An intake structure is located in the reservoir upstream from the toe of the dam. Three slide gates are located at various levels within the structure. A 16-inch diameter cast-iron pipe extends from the base of the intake structure to a point near the upstream toe of the dam. At that point, fittings provide connections with two 10-inch diameter cast-iron pipes that extend through the dam. A valve chamber is located along the downstream side of the corewall. A tunnel extends from the valve chamber to the downstream toe of the dam, providing access to the valve chamber. One gate valve for each 10-inch pipe is located in the valve chamber. From the valve chamber, the two 10-inch pipes extend downstream about 0.3 mile to a treatment plant. There are no conduit outlets at the dam itself, but blowoff valves are located at the treatment plant.

The various features of the dam are shown on the Photographs in Appendix C and on the Plates in Appendix E. A description of the geology is presented in Appendix F.

b. Location. Middle Dam is located on Sambo Creek in Smithfield Township, Monroe County, Pennsylvania, approximately 3 miles north of East Stroudsburg. Middle Dam is shown on USGS Quadrangle East Stroudsburg, Pennsylvania, at latitude N 41° 03' 00" and longitude W 75° 10' 50". A location map is shown on Plate E-1.

c. Size Classification. Small (24 feet high, 197 acre-feet).

d. Hazard Classification. High hazard. Downstream conditions indicate that a high hazard classification is warranted for Middle Dam. (Paragraphs 3.1e and 5.1c (5)).

e. Ownership. Borough of East Stroudsburg, Larry Comunale, Borough Manager, Box 303, East Stroudsburg, Pa. 18301.

f. Purpose of Dam. Water supply for Borough of East Stroudsburg.

g. Design and Construction History. The original design of the dam was performed in 1914 for the Borough of East Stroudsburg by Westbrook and Voss, Civil Engineers and Surveyors, of Stroudsburg, Pennsylvania. Construction was started in 1914 under the supervision of P. L. Voss, of Westbrook and Voss, and W. E. Van Vliet, who was both Superintendent of construction and President of the Borough Council. Numerous changes in design were approved by the Pennsylvania Water Supply Commission (PWSC) while the dam was under construction. Although most of the work was finished by 1916, the dam was not completed in full accordance with the approved plans until 1922. The design drawings for the original construction are shown on Plates E-2 and E-3. Changes that were approved during construction are also shown on those Plates.

In 1930, the Borough wanted to increase the storage capacity of Middle Dam. The design of the necessary modifications was prepared by E. F. Hess, the Borough Engineer. An as-built survey was made by Mr. Hess in 1930 prior to design of the modifications. Results of that survey are shown on Plate E-4. The proposed modifications included raising the embankment by 4 feet and raising the spillway by 3 feet. The spillway crest length was to be increased from 20 feet to 40 feet. The modifications were approved by the Commonwealth. The approved design is shown on Plate E-5. The construction work was performed in 1931 under the supervision of the Borough Engineer, and was the last major change made to the embankment and spillway. Measurements made during the inspection for this Report indicate that the embankment was not modified in accordance with the approved design.

In 1964, a new intake structure was constructed in the reservoir area upstream from the toe of the dam. The design was performed by Buck Seifert and Jost, Consulting Engineers, New York, New York. The old intake structure was abandoned and a pipe from the new intake structure was connected to the two existing pipes that extend through the dam and lead to a treatment plant 0.3 mile downstream. Details of the new intake structure are shown on Plates E-6 and E-7.

h. Normal Operational Procedure. The pool is maintained at the spillway crest level with excess inflow discharging over the spillway. About 1.6 MGD are withdrawn through the intake structure for water supply purposes.

1.3 Pertinent Data.

a.	Drainage Area. (square miles)	2.7
b.	Discharge at Damsite. (cfs.)	
	Maximum known flood at damsite	1955 Flood-unknown discharge.
	Outlet works at maximum pool elevation	N/A No outlet at dam.
	Spillway capacity at maximum pool elevation	
	Design conditions	1,150
	Existing conditions	785
c.	Elevation. (Feet above msl.)	
	Top of dam	
	Design conditions	781.1
	Existing conditions	780.2
	Maximum pool	
	Design conditions	781.1
	Existing conditions	780.2
	Normal pool (spillway crest)	777.1
	Upstream invert outlet works	757.0
	Streambed at toe of dam	756.2
d.	Reservoir Length. (miles)	
	Normal pool	0.30
	Maximum pool	0.34
e.	Storage. (acre-feet)	
	Normal pool	144
	Maximum pool	197
f.	Reservoir Surface. (acres)	
	Normal pool	14
	Maximum pool	20

g.	Dam.	
	Type	Embankment with corewall
	Length (feet)	634
	Height (feet)	24
	Topwidth (feet)	Varies, 3 to 6
	Side Slopes	
	Design conditions	
	Upstream	1V on 3H
	Downstream	1V on 2H
	Existing conditions	
	Upstream	Not Available
	Downstream	Varies, 1V on 1.5H to 1V on 2.3H.
	Zoning	Earthfill upstream; earthfill and rock-fill downstream.
	Cut-off	Stone masonry corewall in trench.
	Grout Curtain	None.
h.	Diversion and Regulating Tunnel.	None.
i.	Spillway.	
	Type	Concrete weir.
	Length of Crest (feet)	40.0
	Crest Elevation	777.10
	Upstream Channel	Reservoir, vertical concrete walls.

i.	Spillway. (Cont'd.) Downstream Channel	Concrete apron and rock-lined channel.
j.	Regulating Outlets. Description	No outlets at dam. Intake structure has 3 gates and a 16-inch diameter cast-iron pipe that feeds two 10-inch dia. water supply lines. Blowoff at treatment plant 0.3 mile downstream.
	Closure	Three slide gates at intake structure; two 10-inch gate valves at downstream side of corewall.
	Access	Intake structure-bridge from top of dam. Gate valves - tunnel from downstream toe of dam.

SECTION 2

ENGINEERING DATA

2.1 Design.

a. Data Available. Engineering data available for review included the following:

(1) Plans for original construction, including changes approved during construction (Plates E-2 and E-3).

(2) Results of an as-built survey performed in August 1930 (Plate E-4).

(3) Plans for proposed modifications of dam and spillway (1931) (Plate E-5).

(4) Plans for intake structure constructed in 1964 (Plates E-6 and E-7).

(5) Specifications for original construction.

(6) Specifications for construction of intake structure.

(7) Permit application reports prepared by the Commonwealth for the original construction and subsequent modifications.

b. Design Features. The project is described in Paragraph 1.2a. The various features of the dam are shown on the Photographs in Appendix C and on the Plates in Appendix E. The embankment is shown on Plates E-2 through E-5 and on Photographs A through E. The spillway is shown on Plates E-2 through E-5 and on Photographs F and G. The outlet works is shown on Plates E-6 and E-7 and on Photographs H and I.

(c) Design Considerations. Design considerations for Middle Dam are discussed in Section 5 and Section 6.

2.2 Construction.

a. Data Available. Construction data available for review included construction photographs and six construction progress reports prepared by the Commonwealth for the original construction. No construction data were available for subsequent modifications.

b. Construction Considerations. A trench averaging about 4 feet deep was excavated for the corewall foundation. The foundation, described as impervious clay and hardpan, was inspected by the Commonwealth and judged to be satisfactory. In August 1914, another inspection was performed by the Commonwealth and the report noted the following deficiencies and/or variations from design:

(1) Mortar for the foundation course of the corewall did not have a suitable proportion of cement and sand. A mix of 1 part cement to 5 parts sand was being used instead of the specified 1 to 2 mix.

(2) Some stone for the corewall were not being cleaned of mud and dirt.

(3) The embankment material was being deposited in layers that were too thick (10-18 inches), large stones were not being removed, dry embankment material was not being wetted, and some portions were not compacted well.

(4) The Engineer reported that the Superintendent of construction would not follow the specifications.

(5) The corewall was found to be about 2 feet thicker than shown on the plans.

The Commonwealth directed that construction practices be modified to conform with the specifications. The Commonwealth inspected the work again in September 1924. The inspection report noted the following:

(1) Mortar quality was improved but not satisfactory. One part cement and three parts sand were being used.

(2) Stones for the corewall were clean.

(3) The earthfill placement was unsatisfactory. Layers were too thick, and no moisture control or compaction was used.

Another inspection was performed by the Commonwealth in November 1914. The dam was nearly complete, and the Commonwealth concluded that the overall appearance was excellent. It was also concluded that deficiencies in construction practices that had occurred would not cause any significant problems.

2.3 Operation. There are no formal records of operation. Periodic inspections have been performed by the Commonwealth. The inspection reports, and statements by the Owner, indicate that no incidents of failure or overtopping are known to have occurred over its 65-year life.

2.4 Evaluation.

a. Availability. Engineering data were provided by the Bureau of Dams and Waterway Management, Department of Environmental Resources, Commonwealth of Pennsylvania. The Owner made available the Borough Manager, the Superintendent of Public Utilities, and the Borough Engineer for information during the visual inspection. He also researched his files for information at the request of the inspection team.

b. Adequacy. The type and amount of available design data and other engineering data are limited, and the assessment must be based on the combination of available data, visual inspection, performance history, hydrologic assumptions, and hydraulic assumptions.

c. Validity. There is no reason to question the validity of the available data.

SECTION 3

VISUAL INSPECTION

3.1 Findings.

a. General. The overall appearance of the dam is fair. Deficiencies were observed as noted below. A sketch of the dam with the location of deficiencies is presented on Exhibit B-1 in Appendix B. Survey information acquired for this report is summarized in Appendix B. On the day of the inspection, the pool was 0.1 foot above spillway crest elevation.

b. Embankment. The top of the embankment is covered with grass. Most of the upstream slope was submerged and could not be inspected. Riprap on the upstream slope is intact, but it does not extend to the top of the dam (Photograph A). The portion of the slope above the riprap is covered with grass.

The downstream slope of the dam is covered with grass and is generally in good condition (Photographs B and C). One bare area about 500 square feet in size exists near the left abutment (Photograph D). The Owner stated that the area was disturbed in 1964 when the intake structure was constructed. No erosion has occurred at the bare area. Two burrowing animal holes are located on the downstream slope.

An extensive network of wet areas is located along the downstream toe of the dam (Photograph E). The affected area extends about 150 feet along the toe of the dam and about 120 feet downstream. No individual sources of seepage could be located, but such sources could easily have been obscured by the relatively deep pools of standing water. All water observed in the wet areas was clear. At the downstream end of the network, there was a small watercourse that seemed to be the outlet for most of the wet areas. A clear flow estimated at 15 to 20 gallons per minute (gpm) was observed.

The survey of the embankment that was performed during the visual inspection was based on the elevation datum used for construction of the intake structure in 1964. The survey indicates that the lowest area on the top of the dam is located about 120 feet from the left abutment. This is the area previously described as having been disturbed during construction of the intake structure. The lowest area is at Elevation 780.2, which is 0.9 foot lower than the design elevation for the top of

the dam. Most of the embankment was about 0.4 foot lower than the design elevation. Although most of the upstream slope was submerged and could not be surveyed, the exposed portion was found to be about 1V on 2H. The measured topwidth of the dam varies from 3 to 6 feet. At the surveyed section, the downstream slope is about 1V on 1.5H from the top of the dam to about Elevation 768, and about 1V on 2.3H from Elevation 768 to the toe of the dam.

c. Appurtenant Structures. The concrete spillway weir is in good condition (Photograph F). Minor cracking and leaching are present on the spillway sidewalls and on the bridge pier. The right wall also had some spalling at the weir. The concrete apron at the toe of the weir on the left side of the spillway is damaged. Pieces of concrete about 3 inches thick are broken and displaced over about a 30-square foot area. It did not appear that the toe of the weir was undermined. Beyond the end of the concrete apron, the spillway outlet channel is in good condition (Photograph G). No erosion is present in the stone-lined channel. The underside of the spillway bridge is at Elevation 781.2, which is 0.1 foot above the design elevation of the top of the dam.

The intake structure located in the reservoir is in good condition (Photograph H). The Superintendent of Public Utilities stated that the three slide gates in the intake structure are all in good working order. Since there are no outlets at the dam, it was not requested that the gates be operated for this inspection. An examination was made of the valve chamber located along the downstream side of the corewall. Standing water about 12 inches deep and mud were present in the tunnel (Photograph I) and valve chamber. The two gate valves were nearly submerged. The source of the water could not be determined. The exposed portion of the corewall in the valve chamber is in good condition. It was damp at several locations, but there were no leaks.

d. Reservoir Area. The watershed is about 90 percent wooded and has only a minor amount of development. East Stroudsburg Dam is located within the watershed about 1.3 miles upstream from Middle Dam (Photograph J). A Phase I Inspection Report was prepared for East Stroudsburg Dam in April 1979.

e. Downstream Channel. No obstructions were located in the downstream channel near the dam. Lower Dam, a small, concrete gravity dam also owned by the Borough of East Stroudsburg, is located about 0.5 mile

downstream. PennDER records indicate that Lower Dam has a storage capacity of about 21 acre-feet. The first dwelling is located about 1.3 miles downstream from Middle Dam. At a distance of 1.7 miles downstream, there is a group of about 10 dwellings constructed close to Sambo Creek. Sambo Creek joins Broadhead Creek, which flows through East Stroudsburg, approximately 3 miles downstream from the dam. It is estimated that at least 10 dwellings would be flooded should Middle Dam fail. Significant property damage farther downstream is also likely.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedure. The reservoir is maintained at the spillway crest with excess inflow discharging over the spillway and into the downstream channel. One of the slide gates at the intake structure is normally open for withdrawal of water for water supply purposes. Both gate valves in the valve chamber are normally open.

4.2 Maintenance of Dam. The dam is visited at least monthly by the Superintendent of Public Utilities. He makes informal inspections of the dam and appurtenant structures. Brush and weeds are cut each spring. Repairs to riprap are made as the need arises.

4.3 Maintenance of Operating Facilities. The operating mechanisms for the slide gates are maintained as needed. The slide gates are operated as necessary to meet water supply needs. Screens in the intake structure are cleaned twice each year. The gate valves in the valve chamber are maintained as needed.

4.4 Warning Systems in Effect. The Owner has no emergency operation and warning system.

4.5 Evaluation of Operational Adequacy. The maintenance of the embankment, spillway, and outlet works is generally good, but some deficiencies do exist. Detailed inspections are necessary to detect hazardous conditions at the dam. An emergency operation and warning system is necessary to reduce the risk of dam failure should adverse conditions develop and to prevent loss of life should the dam fail.

SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. The permit application report for the 1931 modification of the spillway indicates that the spillway design head is 4 feet and that the design weir coefficient is 3.6. The coefficient was considered reasonable and was accepted for use in determining the design capacity for this Report. The existing capacity computed and used for this Report was based on the maximum available head under existing conditions. Data presented in the Phase I Inspection Report for East Stroudsburg Dam, located 1.3 miles upstream from Middle Dam, were used in evaluating the effects of East Stroudsburg Dam on the hydrology of Middle Dam. Conditions that existed at the time of the inspection of East Stroudsburg Dam were used. There is a diversion system that effectively increases the drainage area of East Stroudsburg Dam. The effects of the diversion system were included in the Phase I Inspection Report for that dam.

b. Experience Data. No records of maximum pool levels were available. The 1955 Flood resulting from Hurricane Diane is believed to be the flood of record. The Owner stated that he had no knowledge of the dam being overtopped during any flood.

c. Visual Observations.

(1) General. The visual inspection of Middle Dam, which is described in Section 3, resulted in a number of observations relevant to hydrology and hydraulics. These observations are evaluated herein for the various features.

(2) Embankment. The low areas on the top of the dam limit the existing spillway capacity to less than the design capacity.

(3) Appurtenant Structures. The spillway was in satisfactory condition except for minor maintenance items.

Although blowoff valves exist at the treatment plant, the ability of the existing outlet work

facilities to drawdown the reservoir is questionable because of head losses in the two 1,400-foot long supply lines.

(4) Reservoir Area. East Stroudsburg Dam, located 1.3 miles upstream, does affect the hydrology of Middle Dam. Its effects have been included in the hydrologic analysis.

(5) Downstream Conditions. No conditions were observed downstream that might present significant hazard to Middle Dam. Lower Dam, located 0.5 mile downstream, is judged not to affect the flooding that would occur should Middle Dam fail. Failure of Middle Dam would result in flooding of at least 10 dwellings in the first 1.7 miles downstream from the dam. Additional damage farther downstream is possible. The downstream conditions indicate that a high hazard classification is warranted for Middle Dam.

d. Overtopping Potential.

(1) Spillway Design Flood. According to the criteria established by the Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) for the size (Small) and hazard potential (High) of Middle Dam is between one-half of the Probable Maximum Flood (PMF) and the PMF. Because of the downstream conditions, the PMF is selected as the SDF for Middle Dam. The watershed was modeled with the HEC-1DB computer program. A description of the model is included in Appendix D. The assessment of the dam is based on existing conditions, and the effects of future development are not considered.

(2) Summary of Results. Pertinent results are tabulated at the end of Appendix D. The analysis reveals that Middle Dam can pass about 22 percent of the PMF without overtopping of the dam. The dam is rated at its existing top elevation. At its design top elevation, the dam can pass about 33 percent of the PMF without overtopping of the dam.

(3) Spillway Adequacy. The criteria used to rate the spillway adequacy of a dam are described in Appendix D. Because an occurrence of the 1/2 PMF would result in overtopping of the dam, a failure analysis was performed. Assumptions used to model the failure are described in Appendix D. The resulting outflow was routed through stream sections downstream to the dwellings. Failure of Middle Dam would raise water levels at the

dwellings by 2.1 to 4.8 feet over the levels that existed just prior to failure of the dam. There is an increased hazard for loss of life. Therefore, the spillway capacity is rated as seriously inadequate. If the low areas on the top of the dam were filled to the design elevation, the spillway capacity would still be rated as seriously inadequate.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations.

(1) General. The visual inspection of Middle Dam, which is described in Section 3, resulted in a number of observations relevant to structural stability. These observations are evaluated herein for the various features.

(2) Embankment. The combination of riprap and vegetation on the upstream slope apparently provide adequate protection against wave erosion. However, the narrow topwidth of the dam (3 to 6 feet) requires that the slope protection be inspected frequently and carefully maintained. The downstream slope of the embankment was generally in good condition except for minor maintenance items. Although the slope is steep, there was no evidence of stability problems. The wet areas located downstream from the dam apparently developed shortly after construction was complete. Inspection reports subsequent to 1921 mention seepage at the toe. A report made in 1935 indicates that a 200-foot long reach along the toe was swampy. No quantitative records of flows are available, so changes in conditions cannot be determined. Because of its long history and because no concentrated sources were apparent, the clear seepage was judged not to be a serious deficiency at the time of this inspection.

(3) Appurtenant Structures. The cracking, leaching, and spalling of the concrete spillway sidewalls are maintenance items and do not significantly affect the stability of the structures. The broken and displaced concrete in the apron was minor in terms of effect on stability at the time of the inspection. However, additional deterioration of concrete might lead to significant erosion of underlying material that would affect stability.

The standing water and mud in the valve chamber are undesirable because they could conceal potentially adverse conditions.

b. Design and Construction Data.

(1) Embankment. No stability analyses were available for the embankment. Design drawings for the modified embankment (Plate E-5) indicate that the topwidth of the dam was to be 8 feet and the downstream slope was to be 1V on 2H. Survey information acquired for this Report indicates that the dam was not completed in accordance with the plans. Construction progress reports prepared by the Commonwealth were critical of the original construction of the dam (Paragraph 2.2b.), but they concluded that the dam was satisfactory. Much of the criticism concerned the upstream earthfill, which could not be inspected for this Report.

(2) Spillway. No stability analyses were available for the spillway weir. The spillway design was not approved by the Commonwealth prior to construction. A report by the Commonwealth on the as-built structure indicated dissatisfaction with the design, but stated that it would not fail provided that it was carefully maintained. A stability analysis of the weir was performed for this Report. Numerous assumptions were required for the analysis because the as-built drawing from 1931 did not show all the design details and because the existing structure differs somewhat from the as-built drawing. It was assumed that the difference in appearance is due to minor repairs, and that the 1931 as-built drawings are essentially valid. Earth pressure and uplift were considered in the analyses. The analyses indicated that for normal conditions, pool level at spillway crest, the results do not deviate significantly from stability criteria established by the Office of the Chief of Engineers (OCE). For the assumed maximum loading conditions, pool level at design top of dam elevation, the analysis indicated that the structure might fail by overturning because the resultant was located outside of the toe. It is noted that the analyses performed for this Report are based on limited data and are only approximate.

c. Operating Records. The Owner has no formal records of operation. According to PennDER records, no stability problems have occurred for the dam or appurtenant structures.

d. Post-Construction Changes. Modifications made to the dam are described in Paragraph 1.2g.

e. Seismic Stability. Because the stability of the spillway weir is questionable, it is assumed that the dam could not withstand an earthquake.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety.

(1) Based on available records, visual inspection, calculations, and past operational performance, Middle Dam is judged to be in fair condition. Based on existing conditions, the spillway will pass about 22 percent of the PMF before overtopping of the dam occurs. If the low areas on the top of the dam were filled to the design elevation for the top of the dam, the spillway would pass about 33 percent of the PMF. For either condition, it is judged that the dam could not withstand the depth and duration of overtopping that would occur for the 1/2 PMF. Failure of the dam would cause an increased hazard for loss of life. Therefore, the spillway capacity is rated as seriously inadequate. According to criteria established for these studies, the dam is judged to be unsafe, non-emergency, because the spillway capacity is seriously inadequate.

(2) No stability problems were evident for the embankment. Stability analyses were performed for the spillway weir for this Report. The results do not deviate significantly from recommended guidelines for stability under normal loading conditions, but the results indicate that the weir might fail by overturning under the assumed maximum loading conditions because the resultant was found to be located outside of the toe. It is noted that the analyses were based on a number of assumptions and that the results are only approximate.

(3) There are no drawdown facilities at the dam. Water can be discharged from facilities at a treatment plant located 0.3 mile downstream, but the ability of the facilities to drawdown the reservoir is questionable.

(4) A summary of the features and observed deficiencies is listed below:

Feature and Location	Observed Deficiency
Embankment:	Low areas on top; bare area on downstream slope; burrowing animal holes; seepage and wet areas at toe.
Spillway:	Minor deterioration of concrete sidewalls; apron concrete broken and displaced.
Outlet Works:	No drawdown facilities at dam; standing water in valve chamber.

b. Adequacy of Information. The information available is such that a preliminary assessment of the condition of the dam can be inferred from the combination of visual inspection, past performance, and computations performed prior to and as part of this study.

c. Urgency. The recommendations in Paragraph 7.2 should be implemented immediately.

d. Necessity for Further Investigations. In order to accomplish some of the remedial measures outlined in Paragraph 7.2, further investigations by the Owner will be required.

7.2 Recommendations and Remedial Measures.

a. The following measures are recommended to be undertaken by the Owner, in approximate order of priority, immediately:

(1) Perform additional studies to more accurately ascertain the spillway capacity required for Middle Dam as well as the nature and extent of measures required to provide adequate spillway capacity. Take appropriate action as required.

(2) Make repairs to the spillway apron. Perform additional investigations and studies to more accurately assess the stability of the spillway weir as well as the nature and extent of measures required to provide adequate factors of safety for all expected loading conditions. Take appropriate action as required.

(3) Provide properly designed facilities to collect and dispose of water along the toe of the dam and

in the valve chamber. The facilities should include measurement devices. Seepage should be monitored, and records of seepage should be maintained.

(4) Perform a study to determine whether the reservoir could be drawn down over a reasonable period of time with the existing facilities at the treatment plant. Take appropriate action as required to ensure adequate drawdown facilities.

(5) Undertake remedial measures for other minor maintenance items.

All investigations, designs, and supervision of construction should be performed by a professional engineer experienced in the design and construction of dams. The seepage monitoring program should also be performed or supervised by a professional engineer.

b. In addition, the Owner should institute the following operational and maintenance procedures:

(1) Develop a detailed emergency operation and warning system for Middle Dam.

(2) During periods of unusually heavy rains, provide round-the-clock surveillance of Middle Dam.

(3) When warnings of a storm of major proportions are given by the National Weather Service, the Owner should activate his emergency operation and warning system.

(4) Institute an inspection program such that the dam is inspected frequently. As presently required by the Commonwealth, the program should include a formal annual inspection by a professional engineer experienced in the design and construction of dams. Utilize the results to determine if remedial measures are necessary.

(5) Expand the existing maintenance program so that all features of the dam are properly maintained.

APPENDIX A

CHECKLIST - ENGINEERING DATA

CHECKLIST

ENGINEERING DATA

DESIGN, CONSTRUCTION, AND OPERATION
PHASE I

NAME OF DAM: Middle Dam

NDI ID NO.: PA-00256 DER ID NO.: 45-3

Sheet 1 of 4

ITEM	REMARKS
AS-BUILT DRAWINGS	Design drawings only. See Plates in Appendix E.
REGIONAL VICINITY MAP	See Location Map Plate E-1.
CONSTRUCTION HISTORY	Original construction 1914-1915. Spillway raised 2' in 1916. Dam raised 4', spillway raised 3' and lengthened to 40' 1931. New intake structure 1964.
TYPICAL SECTIONS OF DAM	Available. See Plates in Appendix E.
OUTLETS: Plan Details Constraints Discharge Ratings	Available - See Plates in Appendix E.

ENGINEERING DATA

ITEM	REMARKS
RAINFALL/RESERVOIR RECORDS	None.
DESIGN REPORTS	Permit application reports prepared by Commonwealth for original construction in 1914 and for 1916 and 1931 modifications.
GEOLOGY REPORTS	Report of test pit investigations for original construction. Description of geology included in Appendix F.
DESIGN COMPUTATIONS: Hydrology and Hydraulics Dam Stability Seepage Studies	Spillway capacity estimated in permit application reports.
MATERIALS INVESTIGATIONS: Boring Records Laboratory Field	None.
POSTCONSTRUCTION SURVEYS OF DAM	None.

ENGINEERING DATA

ITEM	REMARKS
BORROW SOURCES	From within reservoir area.
MONITORING SYSTEMS	None.
MODIFICATIONS	1916: Spillway raised 2 feet. 1931: Dam raised 4 feet; spillway lengthened and raised 3 feet. 1964: New intake structure.
HIGH POOL RECORDS	None.
POSTCONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM: Description Reports	None.

ENGINEERING DATA

ITEM	REMARKS
MAINTENANCE AND OPERATION RECORDS	None.
SPILLWAY: Plan Sections Details	Available - See Plates in Appendix E.
OPERATING EQUIPMENT: Plans Details	Available - See Plates in Appendix E.
PREVIOUS INSPECTIONS Dates Deficiencies	1919: Settlement of crest and upstream slope; not completed in accordance with approved plans; general appearance - poor. 1920: Slight settlement upstream from corewall; not in accordance with plans. 1921: Crest irregular; general seepage at toe; not in accordance with plans. 1922: Crest uneven; downstream slope uneven; slight settlement upstream from corewall; downstream toe submerged by spillway backwater; erosion in upstream channel. 1923: Core wall not up to design level; seepage. 1924: Same as 1923.

ENGINEERING DATA

ITEM	REMARKS
PREVIOUS INSPECTIONS (CONT'D)	1925: Brush on upstream slope; slight erosion of wasteway. 1926: Crest uneven; settlement both sides of corewall; slight leakage; wet and swampy at toe. 1928: Crest uneven; brush on upstream slope; swampy at toe left of outlet; downstream end of wasteway undermined. 1932: Settlement of crest after raising; some erosion downstream slope; slight seepage right of spillway; swampy at toe. 1933: Downstream slope irregular; slight settlement; swampy at toe. 1935: Crest from 3"-9" low; slight leakage to right of blowoff; swampy along central 200 feet; conduit leak at toe. 1936: Crest 3"-9" low; brush on slopes; slight leakage to right of blowoff; swampy along central 200 feet 1938: No deficiencies noted. 1941: Crest narrow (4'-5'); brush; downstream slope steeper than approved (1V on 2H); slight leakage in valve chamber; toe wet over considerable length. 1949: Crest 6" low right of spillway; brush; leakage at outlet conduit; swampy along toe. 1957: Crest 3" low right of spillway; leakage at conduit; swampy at toe. 1965: No deficiencies noted.

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECKLIST

VISUAL INSPECTION

PHASE I

Name of Dam: Middle Dam County: Monroe State: Pennsylvania

NDI ID No.: PA-00256 DER ID No.: 45-3

Type of Dam: Earth and rockfill with corewall Hazard Category: High

Date(s) Inspection: 13 November 1979 Weather: Overcast Temperature: 50°

Pool Elevation at Time of Inspection: 777.2 msl/Tailwater at Time of Inspection: 756.3 msl

Inspection Personnel:

A.H. Whitman Jr. (GFCC)
D.R. Ebersole (GFCC)
L. Comunale (Borough Manager)
C. Michaels (Supt. of Public Utilities)
C. Dennis (Hess Engineers - Borough Engineer)

D.B. Wilson (GFCC) Recorder

EMBANKMENT

Sheet 1 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed.	Two burrowing animal holes in embankment.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.	
SLOUGHING OR EROSION: Embankment Slopes Abutment Slopes	None observed.	One area on downstream slope near left abutment is bare. Approx. 500 S.F. area
CREST ALIGNMENT: Vertical Horizontal	See survey data at end of Appendix B.	
RIPRAP FAILURES	Good condition.	Riprap does not extend to top of dam. Vegetation above riprap.

EMBANKMENT

Sheet 2 of 2

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT WITH: Abutment Spillway Other Features	No deficiencies.	
ANY NOTICEABLE SEEPAGE	Widespread wet areas from outlet works to 150' ± left and from toe to 120' ± downstream.	Low areas trap water. One outlet approx. 120' d/s appears to drain wet areas. Clear flow approx. 15-20 gpm.
STAFF GAGE AND RECORDER	None.	
DRAINS	None.	
VALVE CHAMBER AT DOWNSTREAM FACE OF CORE WALL	Corewall damp but no concentrated leaks. Standing water on floor approx. 12" deep.	

OUTLET WORKS

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	N/A - no conduits outlet at the dam.	No blowoffs. Nearest outlet is at treatment plant 0.3 mile downstream.
INTAKE STRUCTURE	Good condition - no deficiencies.	
OUTLET STRUCTURE	Valve chamber - good condition. Standing water on floor approx. 12" deep.	Poor drainage from valve chamber.
OUTLET CHANNEL	N/A	
EMERGENCY GATE	N/A	

UNGATED SPILLWAY

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Good condition.	
APPROACH CHANNEL	Minor fine cracks in concrete walls.	Not considered a deficiency.
DISCHARGE CHANNEL	Walls: minor cracking and leaching. spalling on right wall at weir. Apron: concrete broken and displaced - approx. 30 S.F.	Apron concrete that is displaced approx. 2½" thick. No apparent undermining at toe of weir.
BRIDGE AND PIERS	One pier - fair condition Low chord of bridge above top of dam.	Bridge in good condition.
OUTLET CHANNEL	Rock-lined rectangular channel; steep; good condition.	

INSTRUMENTATION

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	

DOWNSTREAM CHANNEL

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION: Obstructions Debris Other	No obstructions; dry, stone masonry channel. Wooded area downstream.	
SLOPES	Mild to steep.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	1 Dwelling 1.3 miles downstream. Group of approx. 10 dwellings 1.7 miles downstream. Lower Dam 0.5 mile downstream	Estimate approx. 10 dwellings would be flooded by failure of dam.

RESERVOIR AND WATERSHED

Sheet 1 of 1

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Vary - mild to steep.	
SEDIMENTATION	None reported.	
WATERSHED DESCRIPTION	Approx. 90% wooded; minor development.	East Stroudsburg Dam within watershed 1.3 miles upstream. DER No. 45-155. Phase I Inspection 4/79.

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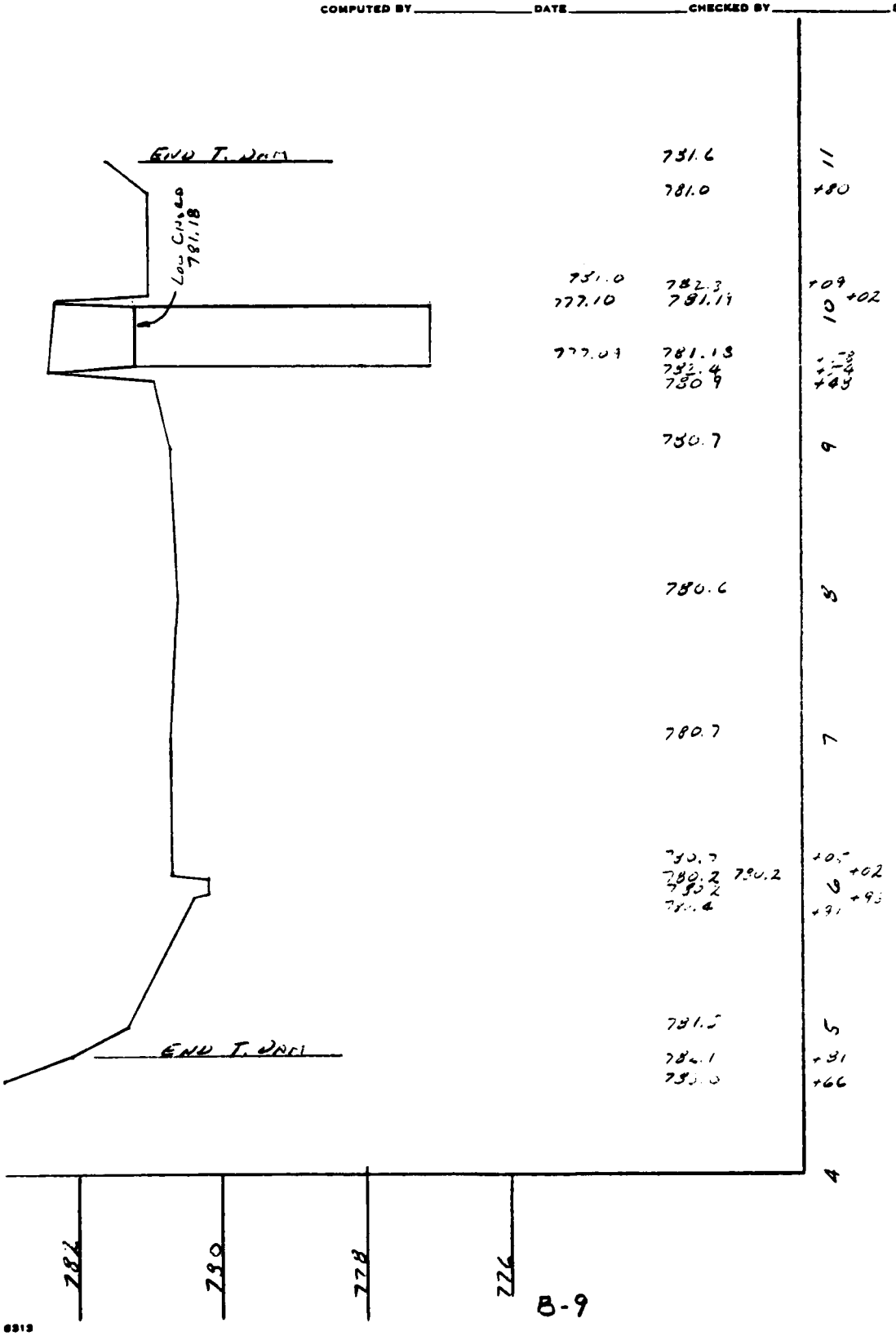
HARRISBURG, PA.

SUBJECT _____ FILE NO. _____
SHEET NO. ____ OF ____ SHEETS
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____



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GANNETT FLEMING CORDDRY AND CARPENTER, INC.
HARRISBURG, PA.

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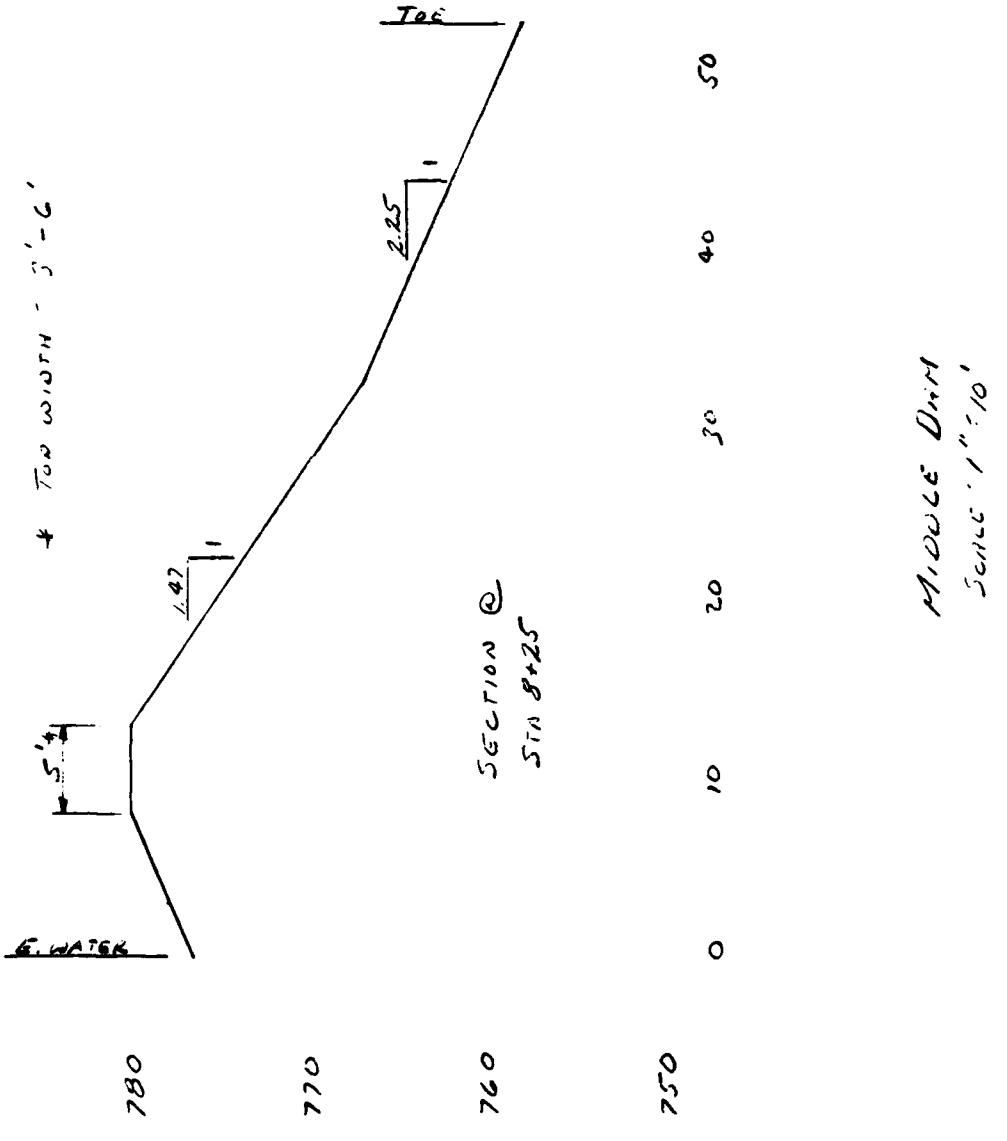
FOR _____
COMPUTED BY _____ DATE _____ CHECKED BY _____ DATE _____

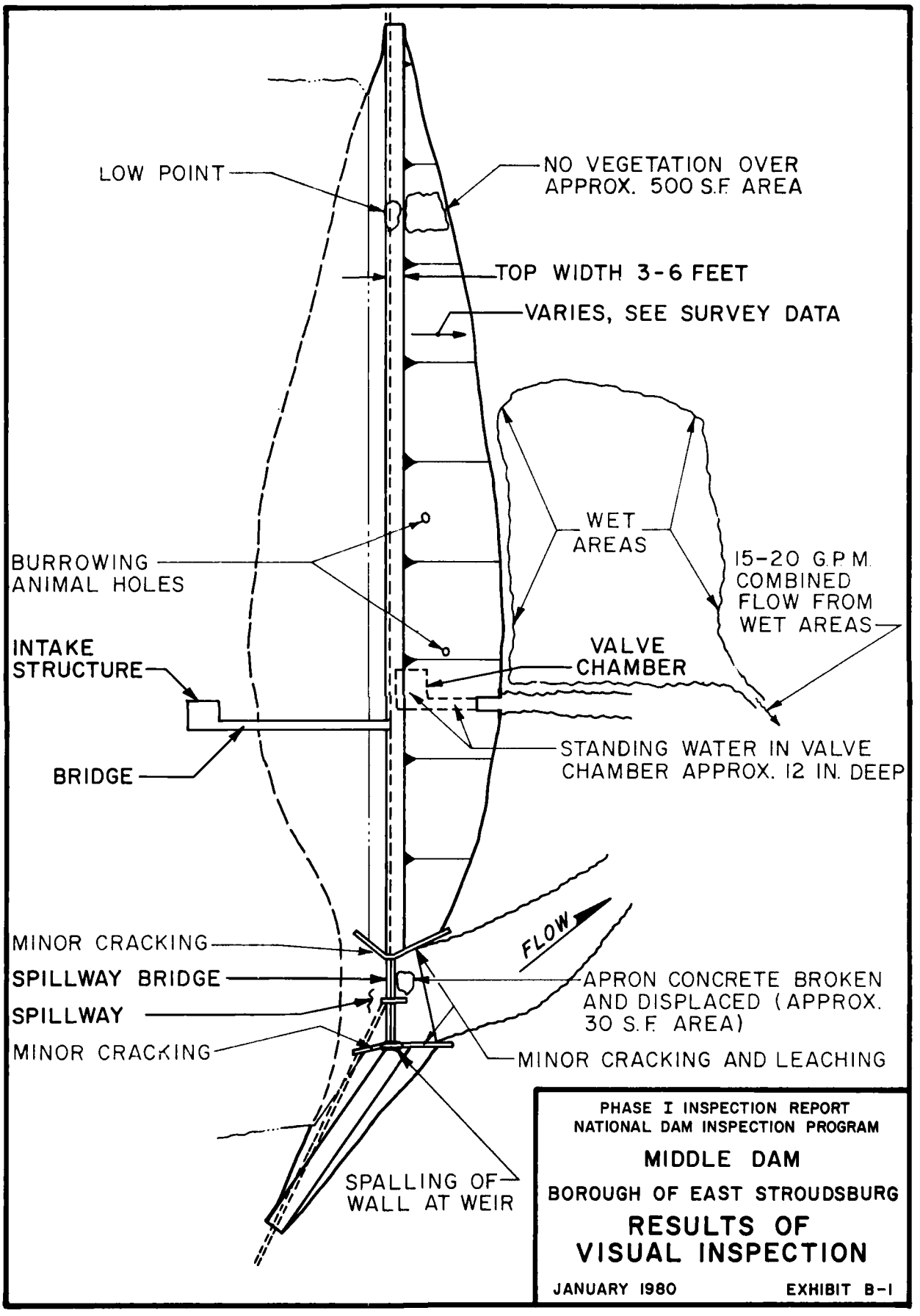


SECTION @
STA 8+25

MIDDLE DAM
SCALE: 1" = 10'

8-10

6913



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MIDDLE DAM

BOROUGH OF EAST STROUDSBURG

RESULTS OF VISUAL INSPECTION

JANUARY 1980 EXHIBIT B-1

APPENDIX C

PHOTOGRAPHS

MIDDLE DAM

A. Top of Dam and Upstream Slope.

B. Embankment. View from Spillway.

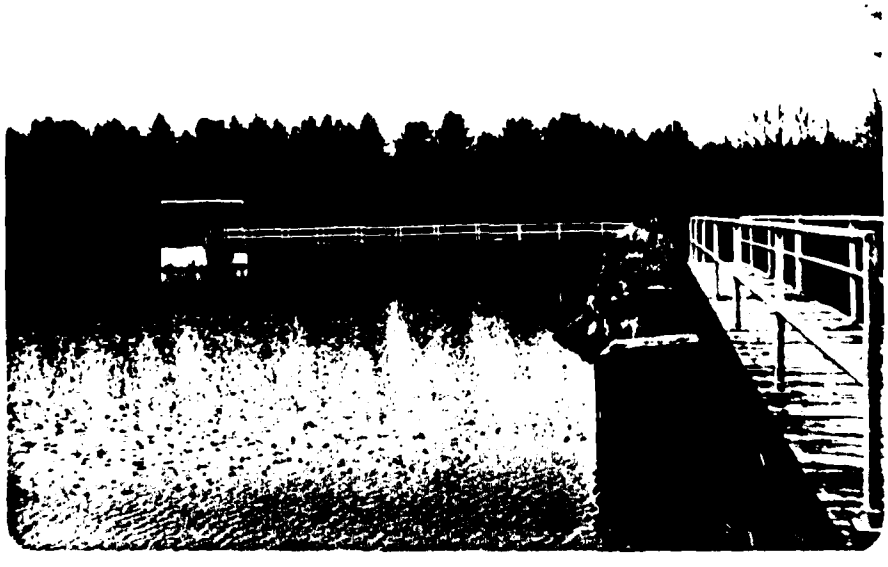
C. Embankment. View from Left Abutment.

D. Downstream Slope Near Left Abutment.

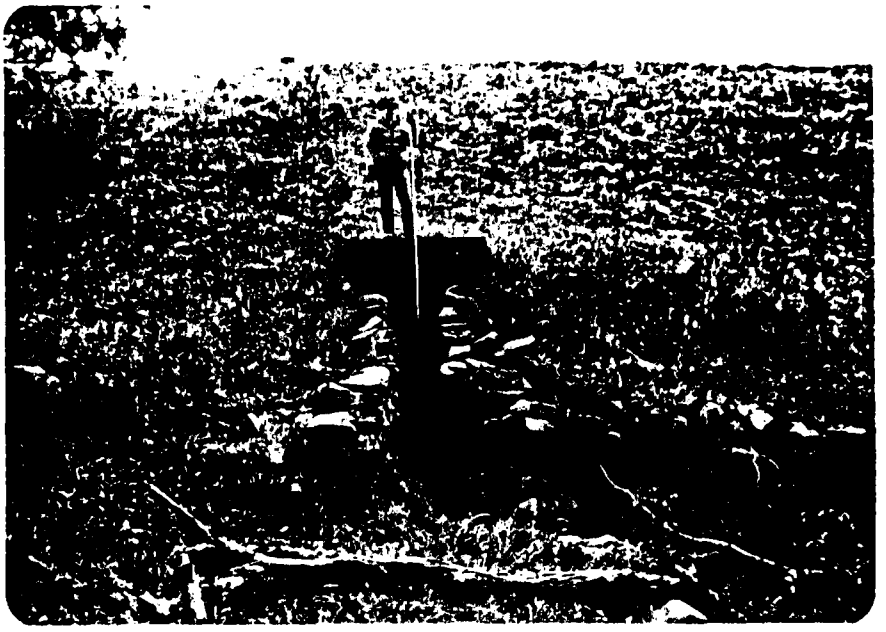
E. Wet Areas at Toe of Dam.

F. Spillway.

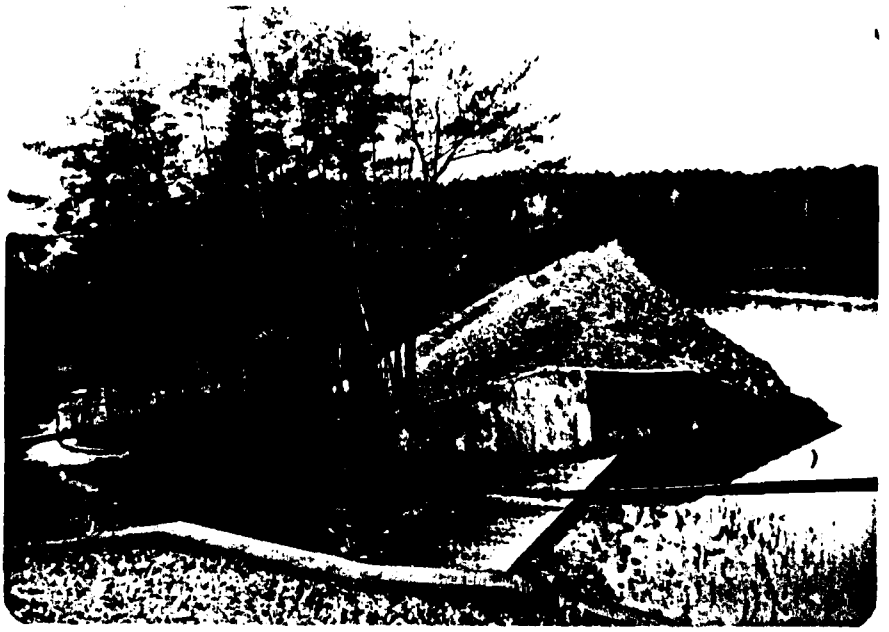
G. Spillway Outlet Channel.



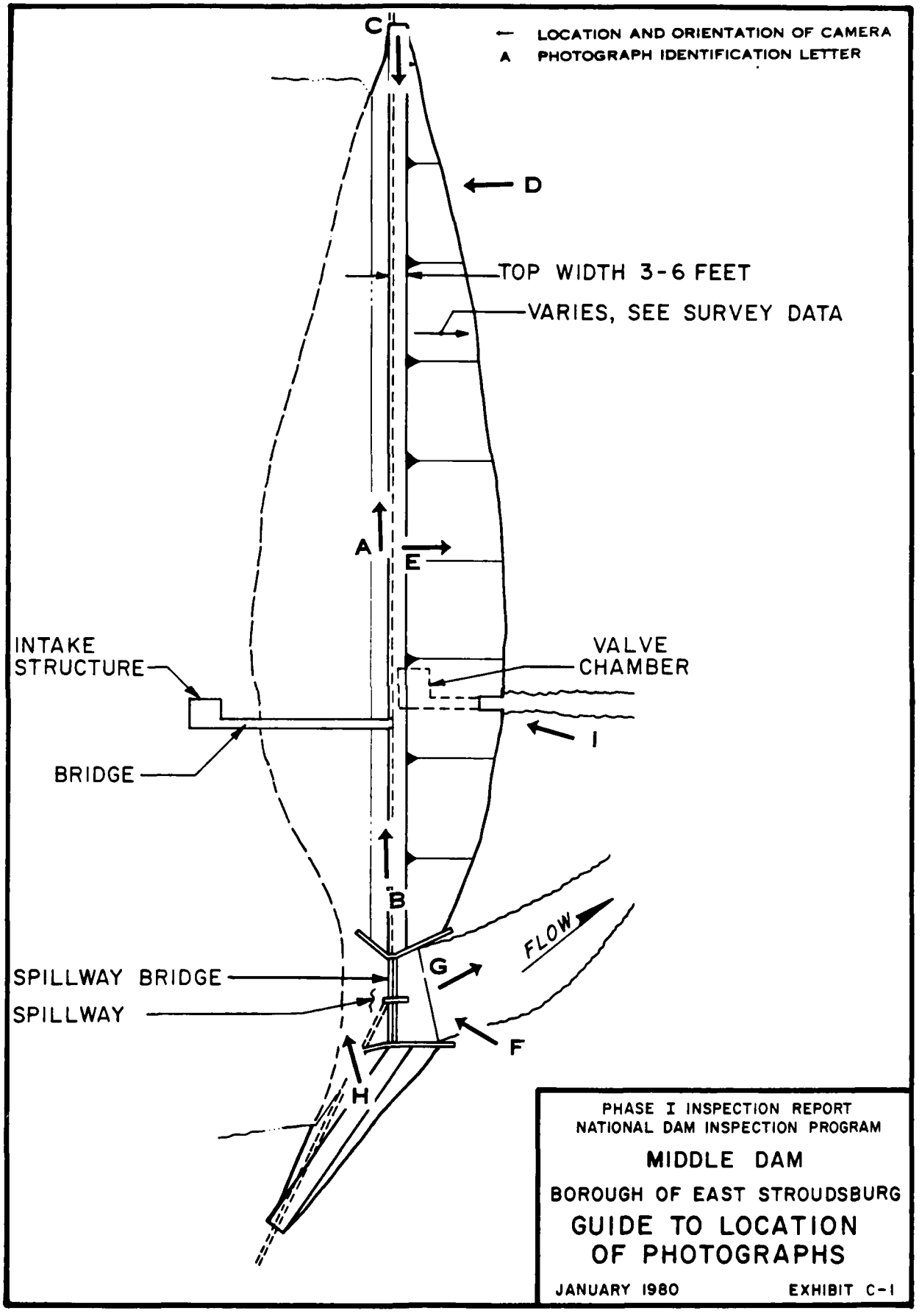
H. Intake Structure.



I. Entrance to Valve Chamber.



J. East Stroudsburg Dam. Located 1.3 Miles Upstream.



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MIDDLE DAM

BOROUGH OF EAST STROUDSBURG

GUIDE TO LOCATION OF PHOTOGRAPHS

JANUARY 1980 EXHIBIT C-1

APPENDIX D

HYDROLOGY AND HYDRAULICS

APPENDIX D

HYDROLOGY AND HYDRAULICS

Spillway Capacity Rating:

In the recommended Guidelines for Safety Inspection of Dams, the Department of the Army, Office of the Chief of Engineers (OCE), established criteria for rating the capacity of spillways. The recommended Spillway Design Flood (SDF) for the size (small, intermediate, or large) and hazard potential (low, significant, or high) classification of a dam is selected in accordance with the criteria. The SDF for those dams in the high hazard category varies between one-half of the Probable Maximum Flood (PMF) and the PMF. If the dam and spillway are not capable of passing the SDF without overtopping failure, the spillway capacity is rated as inadequate. If the dam and spillway are capable of passing one-half of the PMF without overtopping failure, or if the dam is not in the high hazard category, the spillway capacity is not rated as seriously inadequate. A spillway capacity is rated as seriously inadequate if all of the following conditions exist:

(a) There is a high hazard to loss of life from large flows downstream of the dam.

(b) Dam failure resulting from overtopping would significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure.

(c) The dam and spillway are not capable of passing one-half of the PMF without overtopping failure.

Description of Model:

If the Owner has not developed a PMF for the dam, the watershed is modeled with the HEC-1DB computer program, which was developed by the U.S. Army Corps of Engineers. The HEC-1DB computer program calculates a PMF runoff hydrograph (and percentages thereof) and routes the flows through both reservoirs and stream sections. In addition, it has the capability to simulate an overtopping dam failure. By modifying the rainfall criteria, it is also possible to model the 100-year flood with the program.

APPENDIX D

Delaware River Basin
Name of Stream: Sambo Creek
Name of Dam: Middle Dam
NDI ID No.: PA-00256
DER ID No.: 45-3
Latitude: N 41° 05' 00" Longitude: W 75° 10' 50"
Top of Dam Elevation: 780.2 (Low Point)
Streambed Elevation: 756.2 Height of Dam: 24 ft
Reservoir Storage at Top of Dam Elevation: 197 acre-ft
Size Category: Small
Hazard Category: High (see Section 5)
Spillway Design Flood: SDF varies from 1/2 PMF to PMF; Select PMF based on downstream conditions

UPSTREAM DAMS

Name	Distance from Dam (miles)	Height (ft)	Storage at top of Dam Elevation (acre-ft)	Remarks
East Stroudsburg Dam	1.3	48	1,338	Phase I Inspection April 1974 NDI No. PA-00237 DER No. 45-155

DOWNSTREAM DAMS

Lower Dam	0.5	24	21.5	DER No. 45-13 Data from DER inventory

Name of Stream: Sambo Creek Delaware River Basin
Name of Dam: Middle Dam

DETERMINATION OF PMF RAINFALL & UNIT HYDROGRAPH

UNIT HYDROGRAPH DATA:

Sub-area	Drainage Area (square miles)	Cp (1)	Ct (2)	L miles (3)	L_{ca} miles (4)	L' miles (5)	Tp hours (6)	Map Area (7)	Plate (8)
A-1	1.68	0.45	1.23	2.08	1.09	—	1.57	1	A
A-2	1.02	0.45	1.23	2.22	.94	—	1.53	1	A
Total	2.7								

(See Sketch on Sheet D-4)

(1) & (2): Snyder Unit Hydrograph coefficients supplied by Baltimore District, Corps of Engineers on maps and plates referenced in (7) & (8)

The following are measured from the outlet of the subarea:

(3): Length of main watercourse extended to divide

(4): Length of main watercourse to the centroid

The following is measured from the upstream end of the reservoir at normal pool:

(5): Length of main watercourse extended to divide

(6): $Tp=C_t \times (L \times L_{ca})^{0.3}$, except where the centroid of the subarea is located in the reservoir. Then $Tp=C_t \times (L')^{0.6}$

Initial flow is assumed at 1.5 cfs/sq. mile

Computer Data: QRCSN = -0.05 (5% of peak flow)
RTIOR = 2.0

RAINFALL DATA:

PMF Rainfall Index= 22.2 in., 24 hr., 200 sq. mile.

	Hydromet. 40 (Susquehanna Basin)	Hydromet. 33 (Other Basins)
Zone:	N/A	1
Geographic Adjustment Factor:	N/A	1.0
Revised Index Rainfall:	N/A	22.2

RAINFALL DISTRIBUTION (percent)

Time	Percent
6 hours	111
12 hours	123
24 hours	133
48 hours	142
72 hours	—
96 hours	—

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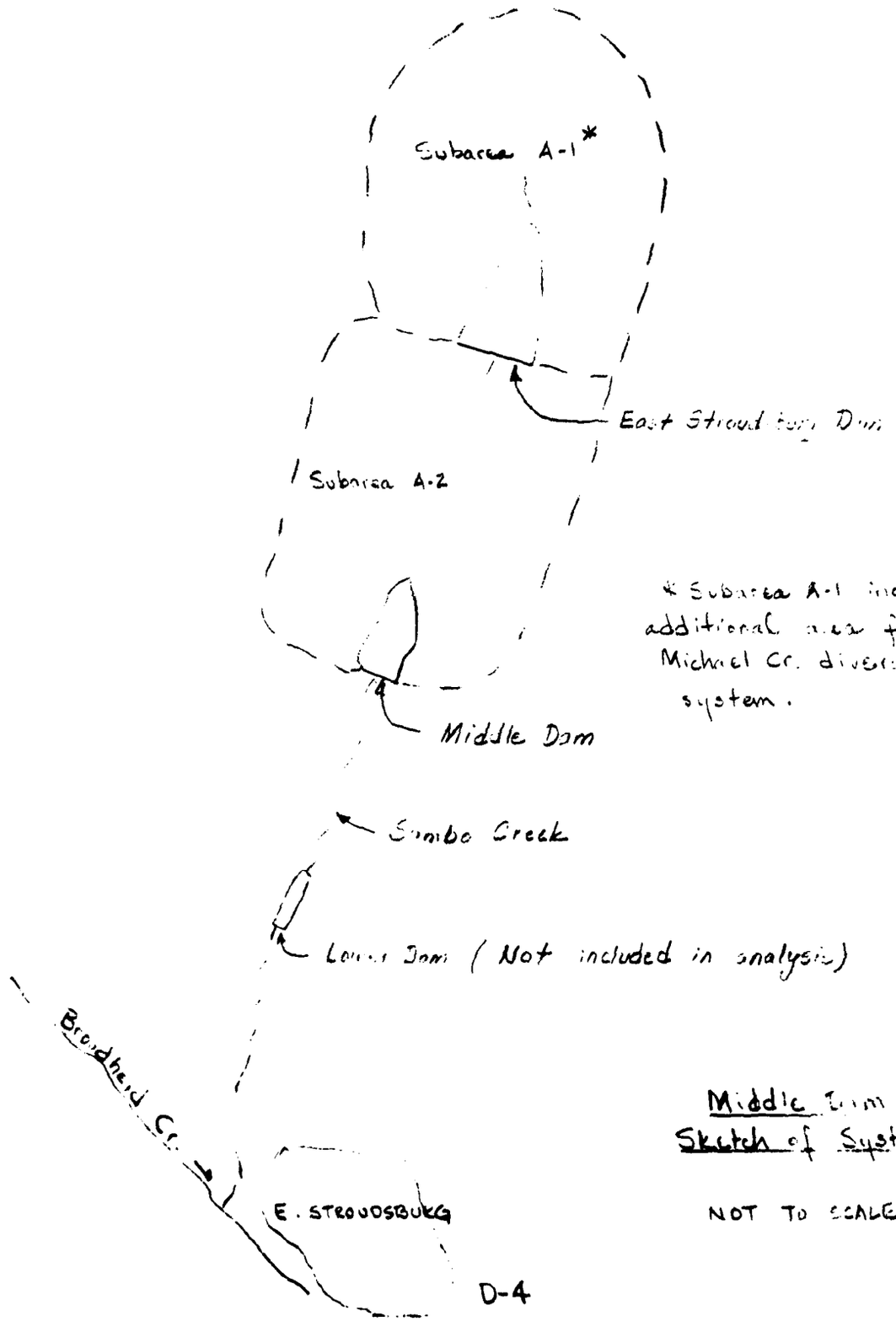


* Subarea A-1 includes additional area from Michael Cr. diversion system.

Middle Dam
Sketch of System

NOT TO SCALE

8312

Data for Dam at Outlet of Subarea A-1 (see Sketch on Sheet D-4)

Name of Dam: East Stroudsburg Dam

SPILLWAY DATA:	Existing Conditions	Design Conditions
Top of Dam Elevation	892.4	
Spillway Crest Elevation	888.0	
Spillway Head Available (ft)	4.4	
Type Spillway	Rectangular section	
"C" Value - Spillway	N/A : Critical depth	
Crest Length - Spillway (ft)	40.0	
Spillway Peak Discharge (cfs)	1,152	
Auxiliary Spillway Crest Elev.	N/A	
Auxiliary Spill. Head Avail. (ft)	N/A	
Type Auxiliary Spillway	N/A	
"C" Value - Auxiliary Spill. (ft)	N/A	
Crest Length - Auxil. Spill. (ft)	N/A	
Auxiliary Spillway Peak Discharge (cfs)	N/A	
Combined Spillway Discharge (cfs)	1,152	

N/A for Analysis of Middle Dam

Spillway Rating Curve: From Phase I Inspection Report April 1979

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)
888.00	0	N/A	N/A
888.50	44		
889.00	124		
890.00	352		
892.00	994		
893.00	1,390		
894.00	1,827		
896.00	2,813		
898.00	3,931	N/A	N/A

OUTLET WORKS RATING:	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet			
Invert of Inlet			
Type			
Diameter (ft) = D			
Length (ft) = L			
Area (sq. ft) = A			
N			
K Entrance			
K Exit			
K Friction=$29.1N^2L/R^{4/3}$			
Sum of K			
$(1/K)^{0.5}$ = C			
Maximum Head (ft) = HM			
Q = CA $\sqrt{2g(HM)}$ (cfs)			
Q Combined (cfs)			

N/A for Analysis of Middle Dam

Data for Dam at Outlet of Subarea A-1 (See sketch on Sheet [illegible]-4)

Name of Dam: East Stroudsburg Dam

STORAGE DATA: From Phase I Inspection Report April 1979

Elevation		Area (acres)		Storage million gals	acre-ft		Remarks
843	=ELEVO*	0		0	0		
853	=ELEV1		=A1		13	=S1	
863					103		
873					303		
883					658		
885					914		
895					1,588		
897					1,800		

* ELEVO = ELEV1 - $(3S_1/A_1)$
** Planimetered contour at least 10 feet above top of dam

Reservoir Area at Normal Pool is 5 percent of subarea watershed.

BREACH DATA: Not Applicable for Analysis of Middle Dam

See Appendix B for sections and existing profile of the dam.

Soil Type from Visual Inspection: _____

Maximum Permissible Velocity (Plate 28, EM 1110-2-1601) _____ fps
(from $Q = CLH^{3/2} = V \cdot A$ and depth = (2/3) x H) & A = L·depth

HMAX = $(4/9\ V^2/C^2)$ = _____ ft., C = ____ Top of Dam El.= ____

HMAX + Top of Dam El. = _____ = FAILEL
(Above is elevation at which failure would start)

Dam Breach Data:

BRWID = _____ ft (width of bottom of breach)
Z = _____ (side slopes of breach)
ELBM = _____ (bottom of breach elevation, minimum of zero storage elevation)
WSEL = _____ (normal pool elevation)
T FAIL= _____ mins = _____ hrs (time for breach to develop)

Data for Dam at Outlet of Subarea A-2 (see Sketch on Sheet D-4)

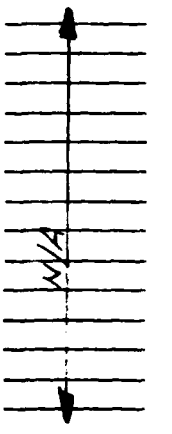
Name of Dam: Middle Dam

SPILLWAY DATA:	Existing Conditions	Design Conditions
Top of Dam Elevation	780.2	781.1
Spillway Crest Elevation	777.1	777.1
Spillway Head Available (ft)	3.1	4.0
Type Spillway	Rounded crest concrete weir	
"C" Value - Spillway	3.6	3.6
Crest Length - Spillway (ft)	40	40
Spillway Peak Discharge (cfs)	785	1,150
Auxiliary Spillway Crest Elev.	N/A	N/A
Auxiliary Spill. Head Avail. (ft)	N/A	N/A
Type Auxiliary Spillway	N/A	N/A
"C" Value - Auxiliary Spill. (ft)	N/A	N/A
Crest Length - Auxil. Spill. (ft)	N/A	N/A
Auxiliary Spillway Peak Discharge (cfs)	N/A	N/A
Combined Spillway Discharge (cfs)	785	1,150

Spillway Rating Curve: $Q = (3.6)(40)(H)^{3/2}$

Elevation	Q Spillway (cfs)	Q Auxiliary Spillway (cfs)	Combined (cfs)

OUTLET WORKS RATING:	Outlet 1	Outlet 2	Outlet 3
Invert of Outlet			
Invert of Inlet			
Type			
Diameter (ft) = D			
Length (ft) = L			
Area (sq. ft) = A			
N			
K Entrance			
K Exit			
K Friction=$29.1N^2L/R^{4/3}$			
Sum of K			
$(1/K)^{0.5} = C$			
Maximum Head (ft) = HM			
$Q = CA\sqrt{2g(HM)}$ (cfs)			
Q Combined (cfs)			



Data for Dam at Outlet of Subarea A-2 (See sketch on Sheet D-4)

Name of Dam: Middle Dam

STORAGE DATA:

Elevation		Area (acres)		Storage million gals	acre-ft		Remarks
743.5	=ELEVO*	0		0	0		
774.1	=ELEV1	10.5	=A1	35	107	=S1	
777.1		14		47	144		Spillway Crest
780.0		20		63	193		
780.2		20		64	197		Low Pt. - Top Dam
800.0	**	62		317	974		

* ELEVO = ELEV1 - $(3S_1/A_1)$

** Planimetered contour at least 10 feet above top of dam

Reservoir Area at Normal Pool is 2 percent of subarea watershed.

BREACH DATA:

See Appendix B for sections and existing profile of the dam.

Soil Type from Visual Inspection: Sandy Silt

Maximum Permissible Velocity (Plate 28, EM 1110-2-1601) 2 fps
(from $Q = CLH^{3/2} = V \cdot A$ and depth = (2/3) x H) & A = L·depth

HMAX = $(4/9\ V^2/C^2)$ = 0.2 ft., C = 3.1 Top of Dam El.= 780.2

HMAX + Top of Dam El. = 780.4 = FAILEL
(Above is elevation at which failure would start)

Dam Breach Data:

BRWID = 80 ft (width of bottom of breach)
Z = 1 (side slopes of breach)
ELBM = 758 (bottom of breach elevation, minimum of zero storage elevation)
WSEL = 777.1 (normal pool elevation)
T FAIL= 6 mins = 0.1 hrs (time for breach to develop)

Selected Computer Output

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************
    1              A1                                NATIONAL DAM INSPECTION PROGRAM
    2              A2                                        SAMBO CREEK
    3              A3                                       MIDDLE DAM
    4              B     300        0       15        0        0        0        0        0       -4        0
    5              R1      5
    6              J       1        7        1
    7              J1    1.0       .7       .6       .5       .4       .3       .2
    8              K       0        1                                            1
    9              K1        RUNOFF INTO EAST STROUDSBURG DAM
   10              M       1        1    1.68                2.7                                 1
   11              P                22.2      111      123      133      142
   12              T                                                           1      .05                .05
   13              W    1.57     0.45
   14              X    -1.5    -0.05      2.0
   15              K       1        1                                            1
   16              K1        ROUTE THROUGH EAST STROUDSBURG DAM
   17              Y                                 1
   18              Y1      1                                                  -888       -1
   19              Y4    886    888.5      889      890      892      893      894      896      898
   20              Y5      0       44      124      352      994     1390     1827     2813     3931
   21              $S      0       13      103      303      658      914     1588     1800
   22              $E    843      853      863      873      883      888      895      897
   23              $$    888
   24              $D  892.4
   25              $L      0        3      200      740      740
   26              $V  892.4    893.6    893.9      894      900
   27              K       1        2                                            1
   28              K1        ROUTE TO MIDDLE DAM
   29              Y                                 1
   30              Y1      1                                                    -1
   31              Y6    .09      .07      .09      817      840     5800     .011
   32              Y7      0      840      300      820      610      820      650      817      660      817
   33              Y7    850      820     1300      840     1800      860
   34              K       0        3                                            1
   35              K1        UNCONTROLLED RUNOFF TO MIDDLE DAM
   36              M       1        1    1.02                2.7                                 1
   37              P                22.2      111      123      133      142
   38              T                                                           1      .05                .02
   39              W    1.57     0.45
   40              X    -1.5    -0.05      2.0
   41              K       2        3                                            1
   42              K1        COMBINE INFLOWS TO MIDDLE DAM
   43              K       1        3                                            1
   44              K1        ROUTE THROUGH MIDDLE DAM
   45              Y                                 1
   46              Y1      1                                                -777.1
   47              $A      0     10.5       14       62
   48              $E  763.5    774.1    777.1      800
   49              $$  777.1       40      3.6      1.5
   50              $D  780.2
```

S1	SL	9	12	35	245	415	550	550
S2	SV	780.2	780.4	780.6	780.7	781	782	790
S3	K	99						

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS						
				RATIO 1 1.00	RATIO 2 .70	RATIO 3 .60	RATIO 4 .50	RATIO 5 .40	RATIO 6 .30	RATIO 7 .20
HYDROGRAPH AT	1	1.68	1	3859.	2701.	2315.	1929.	1543.	1158.	772.
	(	4.35)	(	109.26)(	76.48)(	65.56)(	54.63)(	43.71)(	32.78)(	21.85)(
ROUTED TO	1	1.68	1	3409.	1758.	1452.	1170.	897.	647.	387.
	(	4.35)	(	96.53)(	49.77)(	41.13)(	33.14)(	25.41)(	18.32)(	10.95)(
ROUTED TO	2	1.68	1	3284.	1723.	1429.	1152.	885.	636.	380.
	(	4.35)	(	92.98)(	48.80)(	40.45)(	32.62)(	25.07)(	18.02)(	10.77)(
HYDROGRAPH AT	3	1.02	1	2377.	1664.	1426.	1189.	951.	713.	475.
	(	2.64)	(	67.32)(	47.13)(	40.39)(	33.66)(	26.93)(	20.20)(	13.46)(
2 COMBINED	3	2.70	1	5219.	2854.	2394.	1945.	1519.	1094.	680.
	(	6.99)	(	147.79)(	80.82)(	67.79)(	55.07)(	43.03)(	30.99)(	19.26)(
ROUTED TO	3	2.70	1	5228.	2849.	2390.	1941.	1515.	1087.	664.
	(	6.99)	(	148.03)(	80.68)(	67.67)(	54.97)(	42.91)(	30.77)(	18.82)(

SUMMARY OF DAM SAFETY ANALYSIS

EAST STROUDSBURG DAM

PLAN 1 ..... INITIAL VALUE SPILLWAY CREST TOP OF DAM

ELEVATION	888.00	888.00	892.40
STORAGE	914.	914.	1338.
OUTFLOW	0.	0.	1152.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	894.57	2.17	1547.	3409.	7.50	42.50	0.00
.70	893.80	1.40	1472.	1758.	5.50	43.50	0.00
.60	893.14	.74	1409.	1452.	4.00	43.75	0.00
.50	892.45	.05	1342.	1170.	.75	43.75	0.00
.40	891.70	0.00	1270.	897.	0.00	43.75	0.00
.30	890.92	0.00	1195.	647.	0.00	44.00	0.00
.20	890.11	0.00	1117.	387.	0.00	44.25	0.00

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1.00	3284.	821.0	42.75
.70	1723.	820.2	44.00
.60	1429.	820.0	44.25
.50	1152.	819.8	44.25
.40	885.	819.6	44.50
.30	636.	819.4	44.50
.20	380.	818.8	44.75

SUMMARY OF DAM SAFETY ANALYSIS

MIDDLE DAM

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	777.10	777.10	780.20
STORAGE	144.	144.	194.
OUTFLOW	0.	0.	786.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	782.48	2.28	240.	5228.	13.50	42.75	0.00
.70	781.74	1.54	224.	2849.	11.50	42.75	0.00
.60	781.55	1.35	220.	2390.	10.50	42.75	0.00
.50	781.35	1.15	216.	1941.	9.25	42.75	0.00
.40	781.12	.92	212.	1515.	7.50	43.00	0.00
.30	780.79	.59	205.	1087.	5.25	43.00	0.00
.20	779.87	0.00	188.	664.	0.00	43.25	0.00

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
    1              A1                        NATIONAL DAM INSPECTION PROGRAM
    2              A2                                SAMBO CREEK
    3              A3                                MIDDLE DAM
    4              B     300         0         6         0         0         0         0         0        -4         0
    5              B1      5
    6              J       2         2         1
    7              J1     .5        .3
    8              K       0         1                                                   1
    9              K1        RUNOFF INTO EAST STROUDSBURG DAM
   10              M       1         1      1.68                 2.7                                       1
   11              P                22.2       111       123       133
   12              T                                                                    1       .05                 .05
   13              W    1.57      0.45
   14              X    -1.5     -0.05       2.0
   15              K       1         1                                                   1
   16              K1        ROUTE THROUGH EAST STROUDSBURG DAM
   17              Y                                     1         1
   18              Y1      1                                                        -888        -1
   19              Y4    888       888.5       889       890       892       893       894       896       898
   20              Y5      0          44       124       352       994      1390      1827      2813      3931
   21              SS      0          13       103       303       658       914      1588      1800
   22              SE    843         853       863       873       883       888       895       897
   23              SS    888
   24              SD  892.4
   25              SL      0           3       200       740       740
   26              SV  892.4       893.6     893.9       894       900
   27              K       1           2                                                   1
   28              K1        ROUTE TO MIDDLE DAM
   29              Y                                     1         1
   30              Y1      1                                                         -1
   31              Y6    .09         .07       .09       817       840      5800      .011
   32              Y7      0         840       300       820       610       820       650       817       660       817
   33              Y7    850         820      1300       840      1800       860
   34              K       0           3                                                   1
   35              K1        UNCONTROLLED RUNOFF TO MIDDLE DAM
   36              M       1           1      1.02                 2.7                                       1
   37              P                22.2       111       123       133
   38              T                                                                    1       .05                 .02
   39              W    1.53      0.45
   40              X    -1.5     -0.05       2.0
   41              K       2           3                                                   1
   42              K1        COMBINE INFLOWS TO MIDDLE DAM
   43              K       1           3                                                   1
   44              K1        ROUTE THROUGH MIDDLE DAM
   45              Y                                     1         1
   46              Y1      1                                                      -777.1
   47              SA      0        10.5        14        62
   48              SE  743.5       774.1     777.1       800
   49              SS  777.1          40       3.6       1.5
   50              SD  780.2
```

```
51    $L     9      12      35     245     415     550     550
52    $V 780.7  780.4  780.6  780.7     781     782     790
53    $B    80       1     758      .1   777.1     790
54    $B    80       1     758      .1   777.1   780.4
55    K      1       4                                     1
56    K1       STREAM X-SECT
57    Y                                    1       1
58    Y1     1                                             -1
59    Y6   .09     .07     .09     709     730    1800    .025
60    Y7     0     760     550     740     560     720     570     709     590     709
61    Y7   660     720     850     740    1300     760
62    K      1       5                                     1
63    K1       STREAM X-SECT
64    Y                                    1       1
65    Y1     1                                             -1
66    Y6   .09     .07     .09     550     570    4800     .05
67    Y7     0     600      40     590     110     560     210     550     230     550
68    Y7   300     560     380     580     390     600
69    K      1       6                                     1
70    K1       STREAM X-SECT
71    Y                                    1       1
72    Y1     1                                             -1
73    Y6   .09     .07     .09     510     530    2000    .025
74    Y7     0     560     150     540     200     520     300     510     320     510
75    Y7   400     520     500     540     550     560
76    K      1       7                                     1
77    K1       STREAM X-SECT
78    Y                                    1       1
79    Y1     1                                             -1
80    Y6   .09     .07     .09     456     480     600   .0043
81    Y7     0     480     350     460    1150     460    1250     456    1270     456
82    Y7  1275     460    1430     460    1840     480
83    K     99
```

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50	RATIO 2 .30
HYDROGRAPH AT	1	1.68	1	1920.	1152.
	(	4.35)	(	54.36)(	32.62)(
			2	1920.	1152.
			(	54.36)(	32.62)(
ROUTED TO	1	1.68	1	1143.	631.
	(	4.35)	(	32.38)(	17.86)(
			2	1143.	631.
			(	32.38)(	17.86)(
ROUTED TO	2	1.68	1	1125.	620.
	(	4.35)	(	31.86)(	17.56)(
			2	1125.	620.
			(	31.86)(	17.56)(
HYDROGRAPH AT	3	1.02	1	1184.	711.
	(	2.64)	(	33.54)(	20.12)(
			2	1184.	711.
			(	33.54)(	20.12)(
2 COMBINED	3	2.70	1	1903.	1067.
	(	6.99)	(	53.88)(	30.23)(
			2	1903.	1067.
			(	53.88)(	30.23)(
ROUTED TO	3	2.70	1	1901.	1058.
	(	6.99)	(	53.83)(	29.97)(
			2	21272.	21074.
			(	602.36)(	596.74)(
ROUTED TO	4	2.70	1	1901.	1058.
	(	6.99)	(	53.83)(	29.96)(
			2	13348.	13051.
			(	377.96)(	369.57)(
ROUTED TO	5	2.70	1	1899.	1056.
	(	6.99)	(	53.78)(	29.91)(
			2	11250.	11078.
			(	318.58)(	313.69)(
ROUTED, TO	6	2.70	1	1899.	1056.
	(	6.99)	(	53.76)(	29.90)(
			2	9838.	9619.
			(	278.59)(	272.37)(
ROUTED TO	7	2.70	1	1897.	1055.
	(	6.99)	(	53.72)(	29.87)(

2 8883. 8723.
(251.54)(247.00)(

SUMMARY OF DAM SAFETY ANALYSIS

EAST STROUDSBURG DAM

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	888.00	888.00	892.40
STORAGE	914.	914.	1338.
OUTFLOW	0.	0.	1152.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	892.38	0.00	1335.	1143.	0.00	19.70	0.00
.30	890.87	0.00	1190.	631.	0.00	20.00	0.00

PLAN 2 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	888.00	888.00	892.40
STORAGE	914.	914.	1338.
OUTFLOW	0.	0.	1152.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	892.38	0.00	1335.	1143.	0.00	19.70	0.00
.30	890.87	0.00	1190.	631.	0.00	20.00	0.00

D-19

PLAN 1 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1125.	819.8	20.30
.30	620.	819.3	20.60

PLAN 2 STATION 2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1125.	819.8	20.30
.30	620.	819.3	20.60

SUMMARY OF DAM SAFETY ANALYSIS

MIDDLE DAM

PLAN 1 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	777.10	777.10	780.20
STORAGE	144.	144.	194.
OUTFLOW	0.	0.	786.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	781.33	1.13	216.	1901.	9.00	18.90	0.00
.30	780.76	.56	205.	1058.	5.00	19.10	0.00

PLAN 2 ••••••••••••••••

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	777.10	777.10	780.20
STORAGE	144.	144.	194.
OUTFLOW	0.	0.	786.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	780.42	.22	198.	21272.	.23	16.40	16.30
.30	780.43	.23	198.	21074.	.43	17.70	17.60

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1901.	714.8	18.90
.30	1058.	713.3	19.20

PLAN 2 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	13348.	722.6	16.50
.30	13051.	722.5	17.80

PLAN 1 STATION 5

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1899.	554.0	19.00
.30	1056.	553.1	19.30

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	11250.	558.7	16.50
.30	11078.	558.7	17.80

PLAN 1 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1899.	514.6	19.10
.30	1056.	513.5	19.40

PLAN 2 STATION 6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	9838.	519.4	16.60
.30	9619.	519.3	17.90

PLAN 1 STATION 7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	1897.	460.7	19.20
.30	1055.	460.1	19.50

PLAN 2 STATION 7

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	8883.	462.8	16.60
.30	8723.	462.8	17.90

Middle Dam
Summary of Pertinent Results

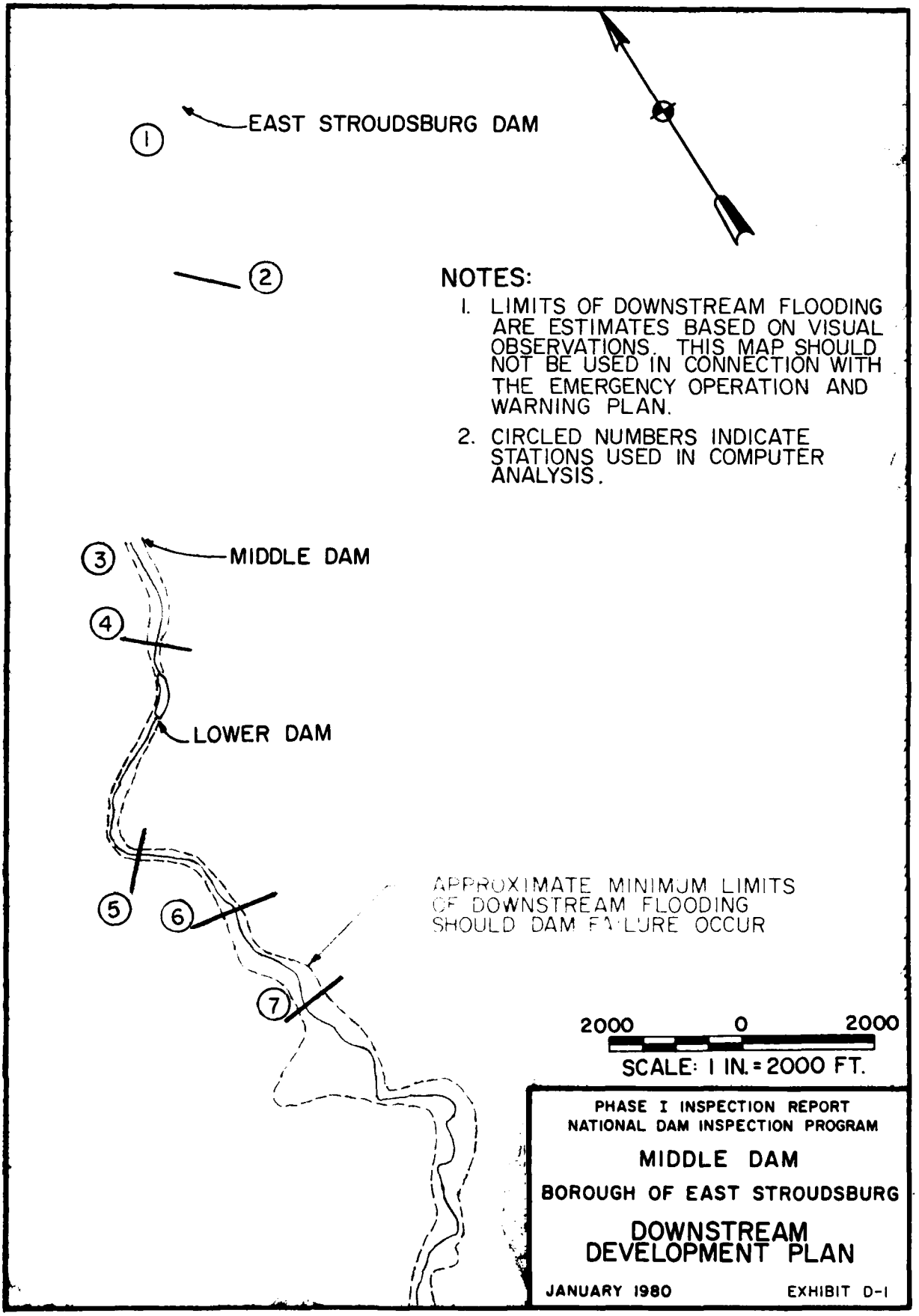
PMF Rainfall = 25.2 inches
PMF Runoff = 22.9 inches

Multi-ratio Analysis:	PMF	½ PMF
East Stroudsburg Dam:		
Inflow (cfs)	3,859	1,179
Outflow (cfs)	3,409	1,170
Depth of Overtopping (feet)	2.17	0.05
Duration of Overtopping (hours)	7.5	0.8
Middle Dam:		
Inflow (cfs)	5,200	1,945
Outflow (cfs)	5,200	1,941
Depth of Overtopping (feet)	2.28	1.15
Duration of Overtopping (hours)	13.5	1.3

Breach Analysis - Middle Dam (½ PMF):

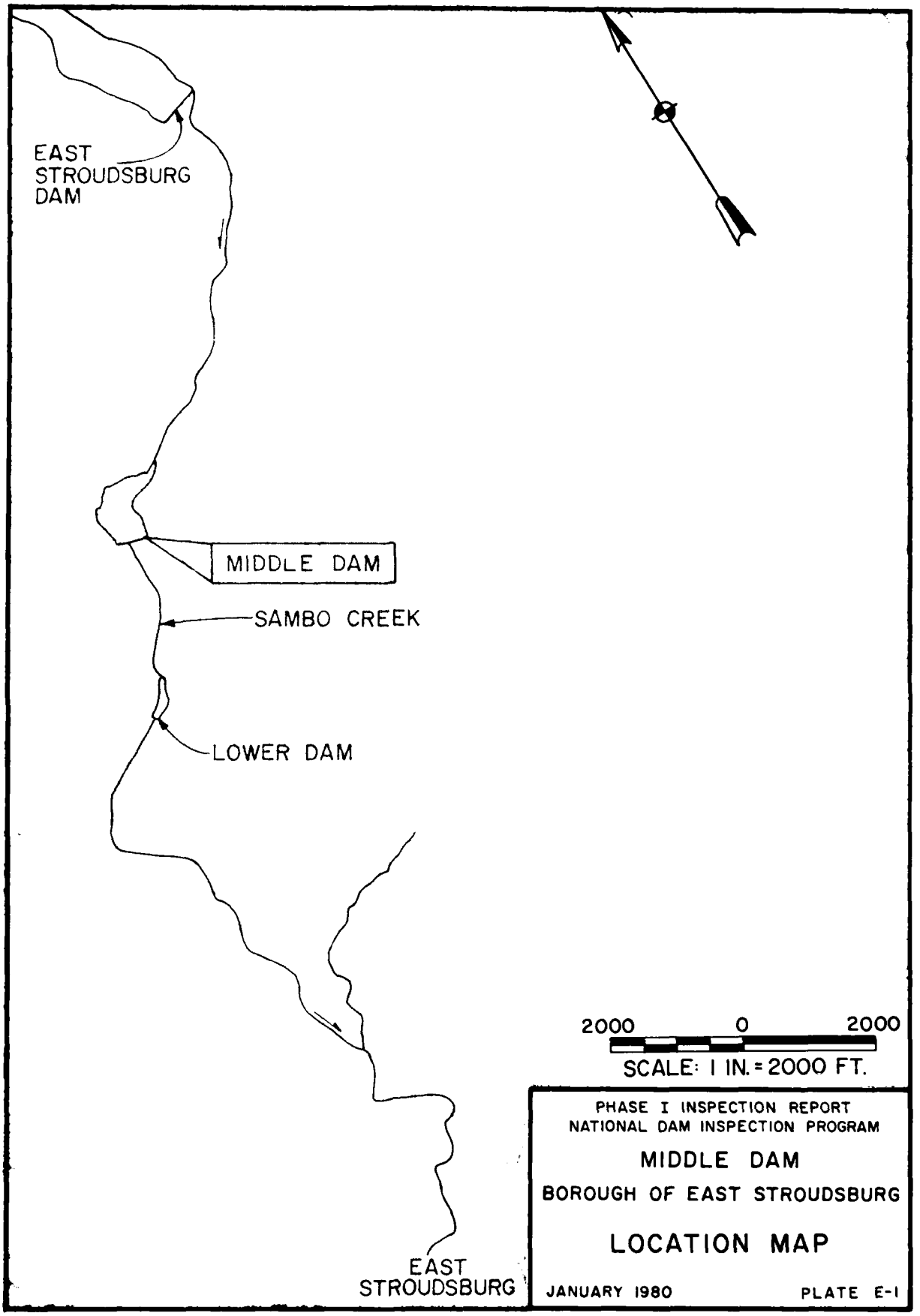
Station Number	Stream Depth (ft) No Failure	Failure	Δ Depth (ft)
6	4.6	9.4	4.8
7	4.7	6.8	2.1

Notes:
1. Breach analysis for Middle Dam did not consider possible failure of East Stroudsburg Dam.
2. Station Number Identification:
   Station 6 : 1 Dwelling
   Station 7 : 9 Dwellings


EAST STROUDSBURG DAM
1
2
NOTES:
1. LIMITS OF DOWNSTREAM FLOODING ARE ESTIMATES BASED ON VISUAL OBSERVATIONS. THIS MAP SHOULD NOT BE USED IN CONNECTION WITH THE EMERGENCY OPERATION AND WARNING PLAN.
2. CIRCLED NUMBERS INDICATE STATIONS USED IN COMPUTER ANALYSIS.
3
MIDDLE DAM
4
LOWER DAM
5
6
7
APPROXIMATE MINIMUM LIMITS OF DOWNSTREAM FLOODING SHOULD DAM FAILURE OCCUR
2000 0 2000
SCALE: 1 IN. = 2000 FT.
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
MIDDLE DAM
BOROUGH OF EAST STROUDSBURG
DOWNSTREAM DEVELOPMENT PLAN
JANUARY 1980
EXHIBIT D-1

APPENDIX E

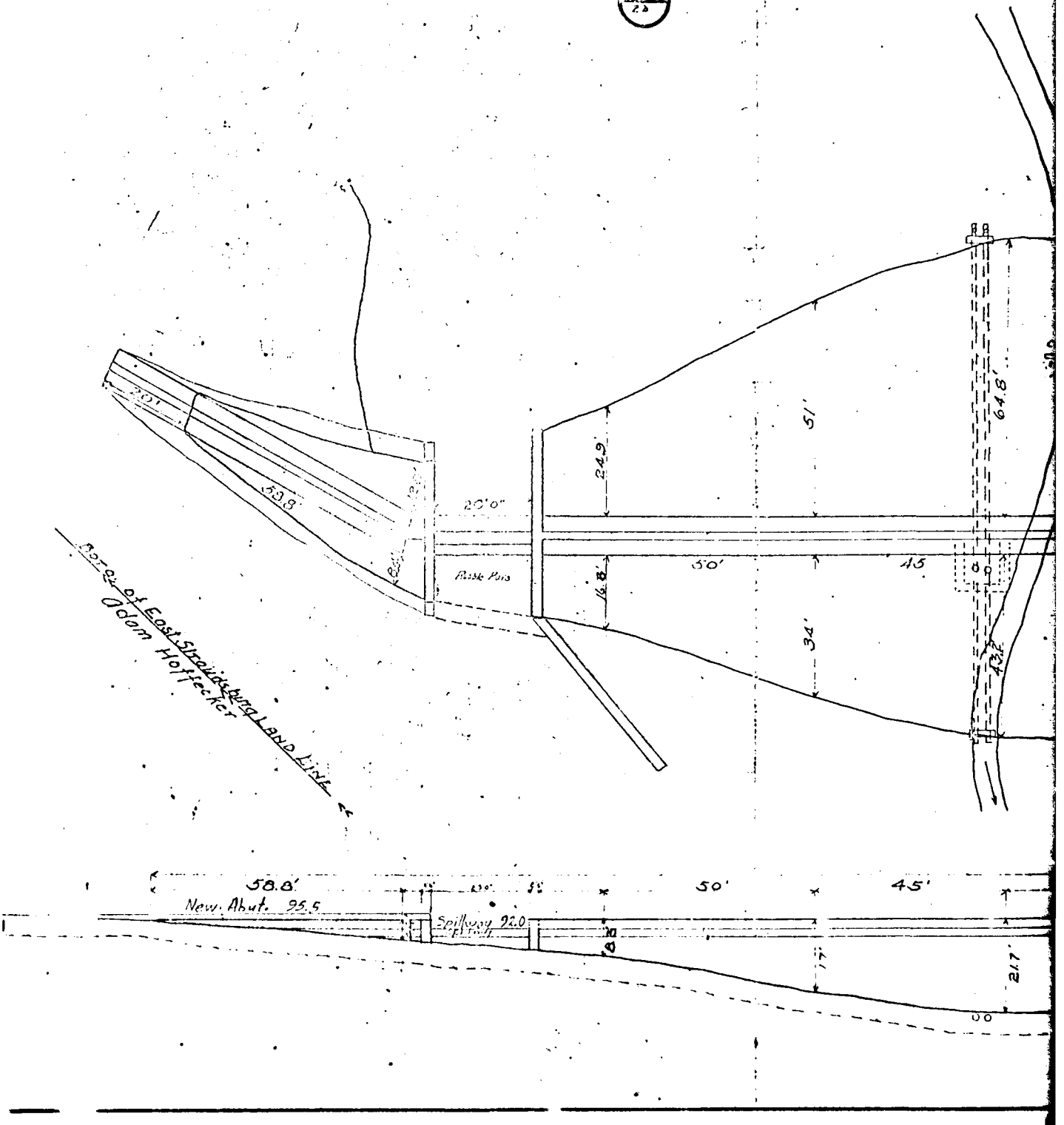
PLATES

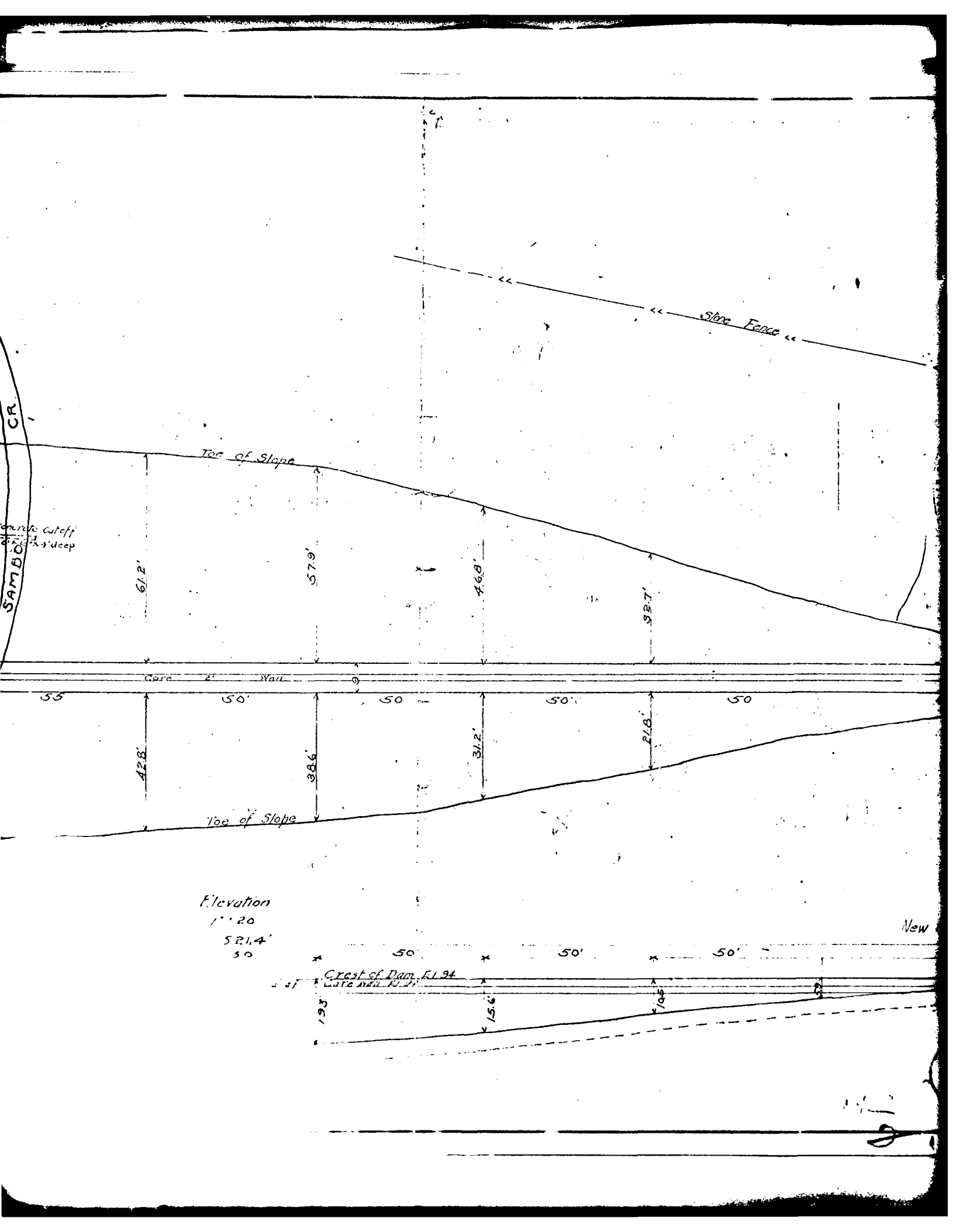

EAST
STROUDSBURG
DAM
MIDDLE DAM
SAMBO CREEK
LOWER DAM
EAST
STROUDSBURG
2000 0 2000
SCALE: 1 IN. = 2000 FT.
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
MIDDLE DAM
BOROUGH OF EAST STROUDSBURG
LOCATION MAP
JANUARY 1980
PLATE E-1

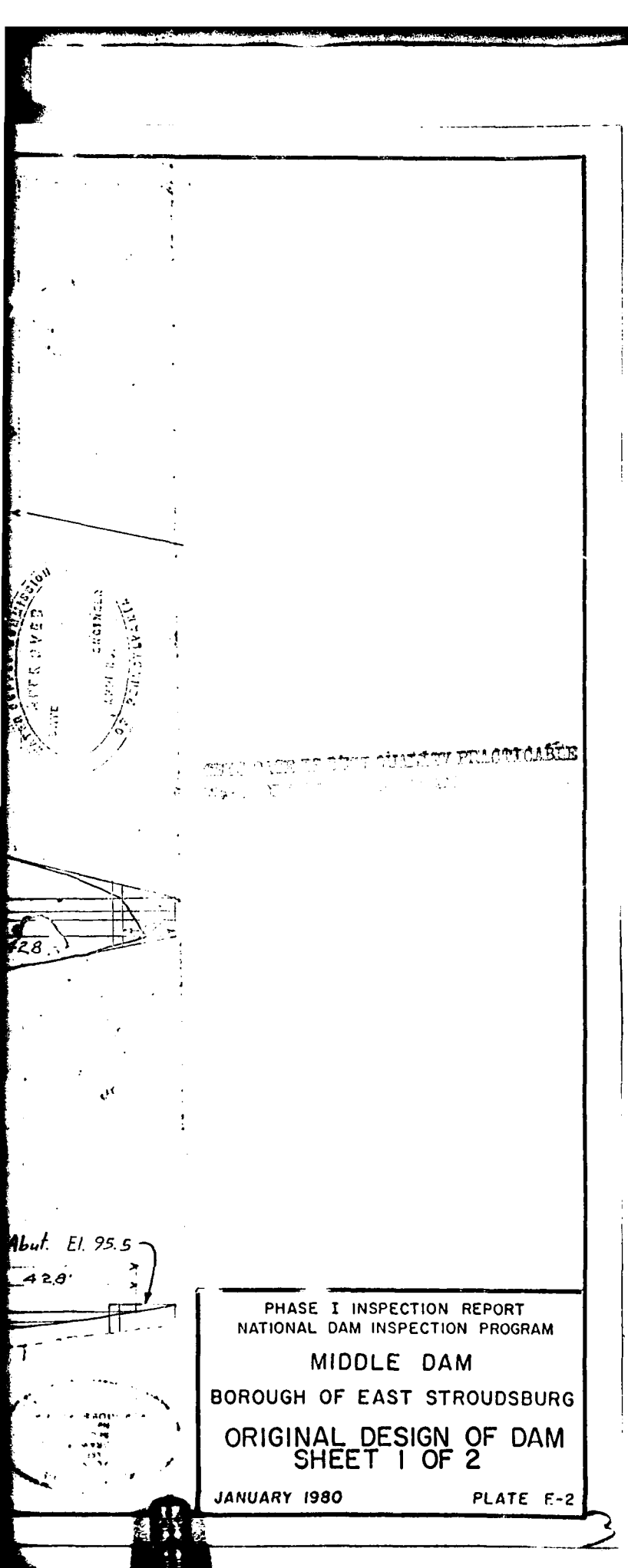
PLAN OF DAM
BORO OF EAST STROUDSBURG
PROPOSED STORAGE RESERVOIR

Scale 1" = 20' July 15 1914

[illegible] STROUDSBURG
Civil Engineers,
STROUDSBURG, PA.




Stone Fence
Toe of Slope
SAMBO CR.
61.2'
57.9'
46.0'
32.7'
Care 2' Wall
55
50'
50
50'
50
42.8'
38.6'
31.2'
21.8'
Toe of Slope
Elevation
1" = 20
521.4'
50
50
50'
50'
Crest of Dam El 94
15.6'
14.5'
New



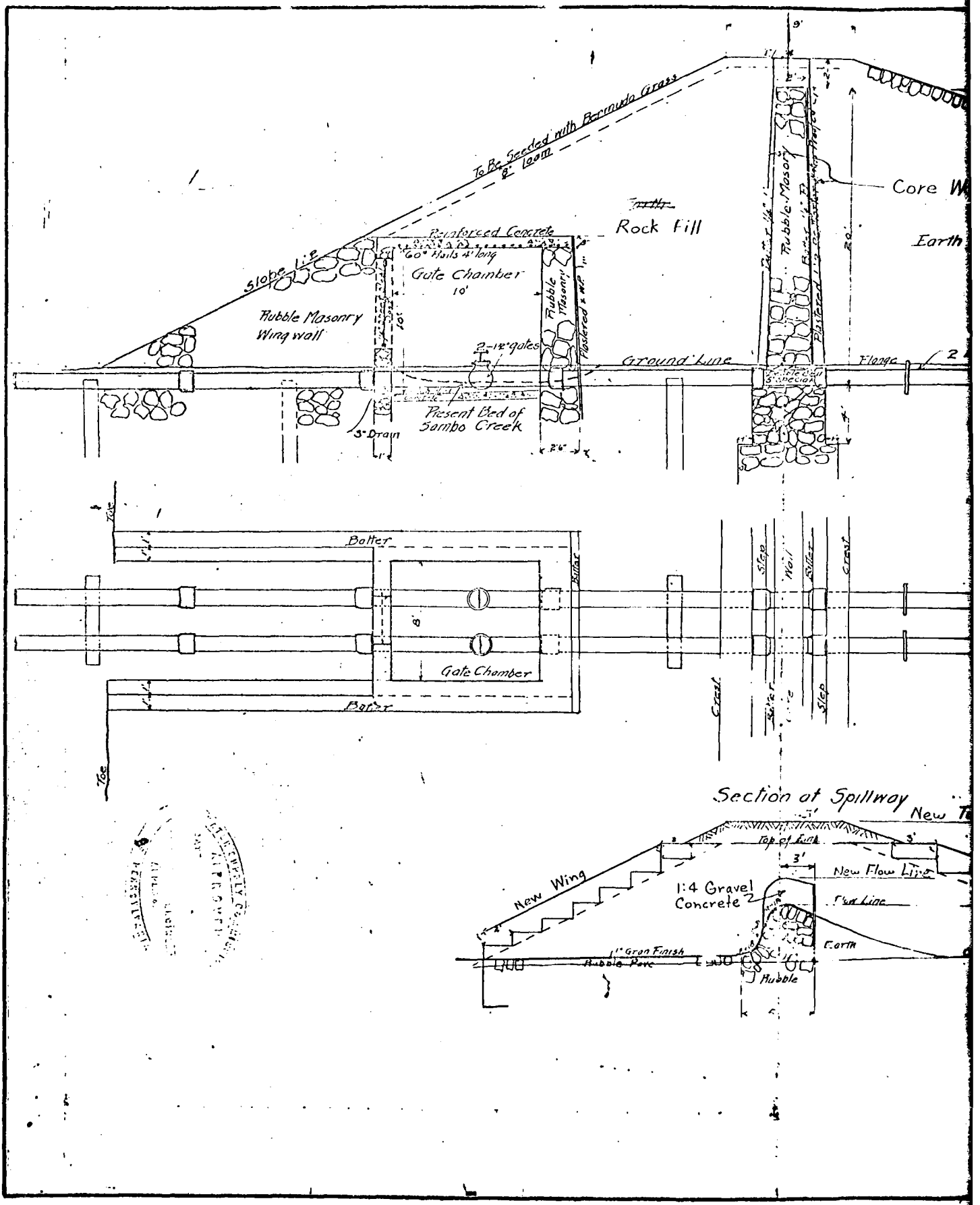
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MIDDLE DAM

BOROUGH OF EAST STROUDSBURG

ORIGINAL DESIGN OF DAM
SHEET 1 OF 2

JANUARY 1980 PLATE E-2


To Be Seeded with Bermuda Grass
8" loam
Rock Fill
Reinforced Concrete
60" Rails 4' long
Gate Chamber
10'
Slope 1:2
Rubble Masonry
Wing wall
2-12" gates
Rubble Masonry
Plastered 1 x 1½"
Ground Line
Flange
Present Bed of
Sambo Creek
3" Drain
Core W
Earth
Rubble Masonry
Plastered 1 x 1½"
Batter
Gate Chamber
Batter
Toe
Toe
Step
Wall
Batter
Crest
Crest
Step
Section at Spillway
New
Top of Earth
3'
3'
New Flow Line
New Wing
1:4 Gravel
Concrete
Flow Line
Earth
1" Gran Finish
Rubble Conc
Rubble

DETAIL SHEET
BORO OF EAST STROUDSBURG
PROPOSED STORAGE RESERVOIR

May 10 1914

Proposed Alterations in Red
Sept. 15. 1915
Westbrook & Voss

E.S. 3a

Section at Gate Chamber
1" = 5'

New Spillway El. 92

El 90.0

Paving

Slope 1:3

As Constructed

Rip Rap

Rip Rap

Rip Rap

Rip Rap

Copper Screen

copper Cap

3.3'

W.I. Sleeve

12'3"

12" C.I.P

Flange

Flange

Flange

Flange

Rubble

Rubble

Rubble
4'6"

Note: All Pillars same Dimensions & similarly spaced

Plan at Gate Chamber
1" = 5'

6'

6'

Plug

9'

2'

Plan of Spillway
1" = 5'

16'4"

Curve

Slope

Curve

Crest

29'

Top of Backfill

Paved Apron

of Earth

New Wing

3

Line

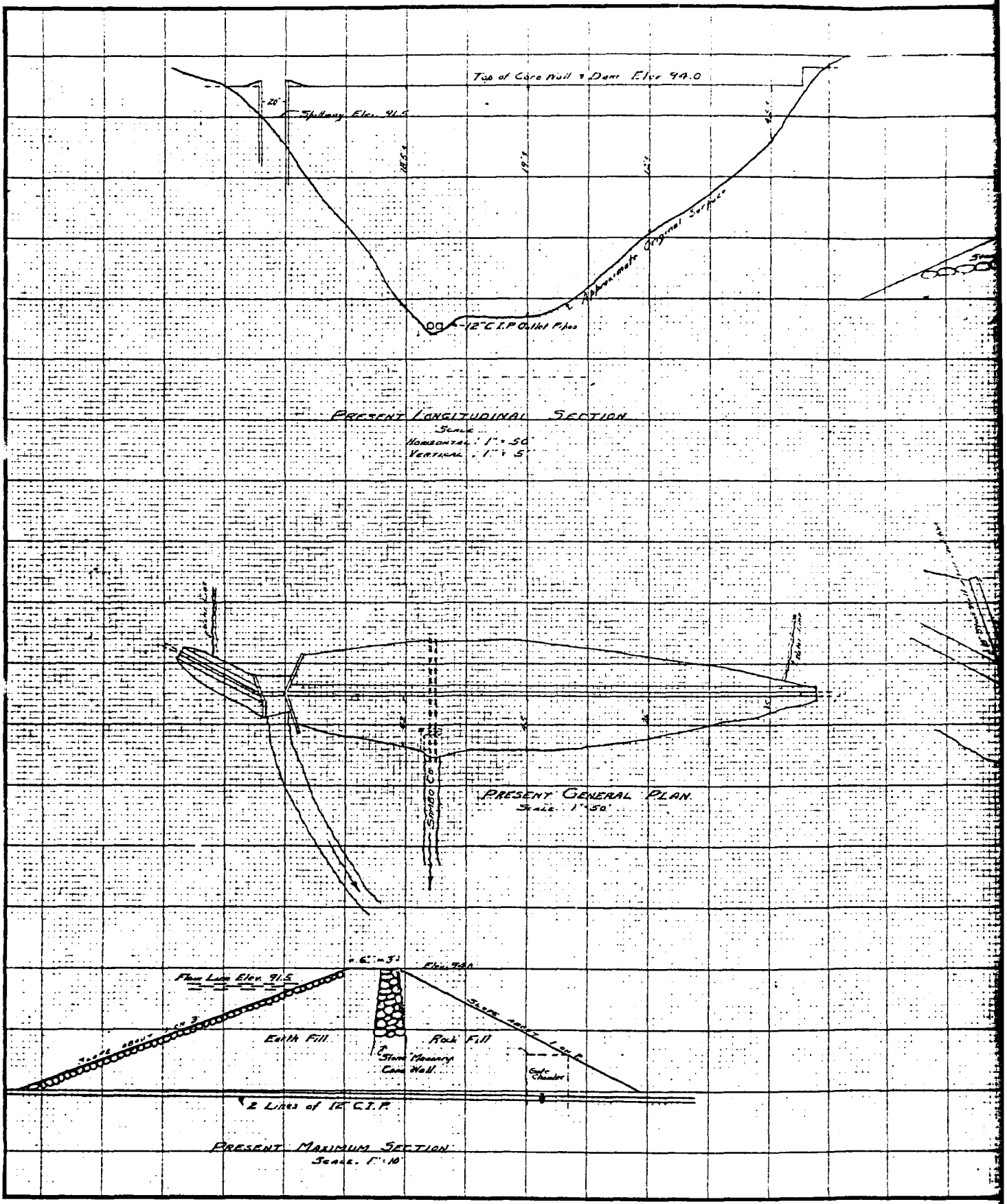
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

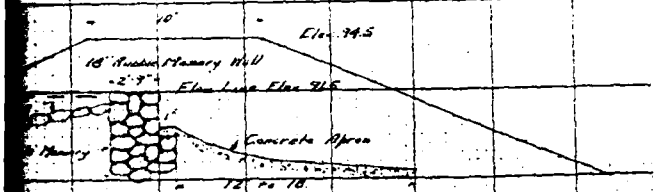
MIDDLE DAM

BOROUGH OF EAST STROUDSBURG

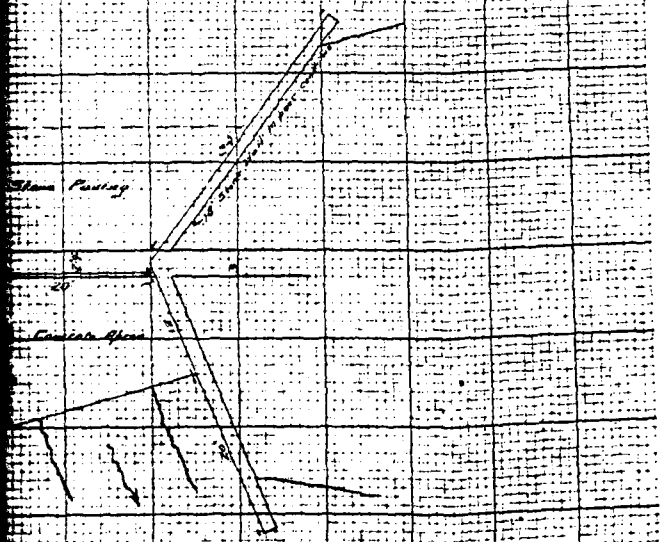
ORIGINAL DESIGN OF DAM
SHEET 2 OF 2

JANUARY 1980 PLATE E-3


Top of Core Wall & Dam Elev 94.0
20'
Spillway Elev. 91.5
Approximate Original Surface
12" C.I.P Outlet Pipe
PRESENT LONGITUDINAL SECTION
Scale
Horizontal 1" = 50'
Vertical 1" = 5'
Stone Masonry Core Wall
PRESENT GENERAL PLAN.
Scale 1" = 50'
Flow Line Elev. 91.5
Earth Fill
Rock Fill
Stone Masonry Core Wall
Cut Chamber
2 Lines of 12" C.I.P.
PRESENT MAXIMUM SECTION
Scale 1" = 10'



SECTION OF SPILLWAY
SCALE, 1"=5'



SPILLWAY PLAN
SCALE 1"=10'

PLAN OF PRESENT DAM
AT
EAST STROUDSBURG STORAGE RESERVOIR
ON
SAMUEL CREEK, SMITHFIELD TWP, MONROE CO, PA.

DRAINAGE AREA = 1.36 SQ. MI.
AREA FLOODED = 10.5 A.
DAM CONSTRUCTED IN 1914

AUG 1930 LEWIS S. [illegible] C.E.
STROUDSBURG, PA.

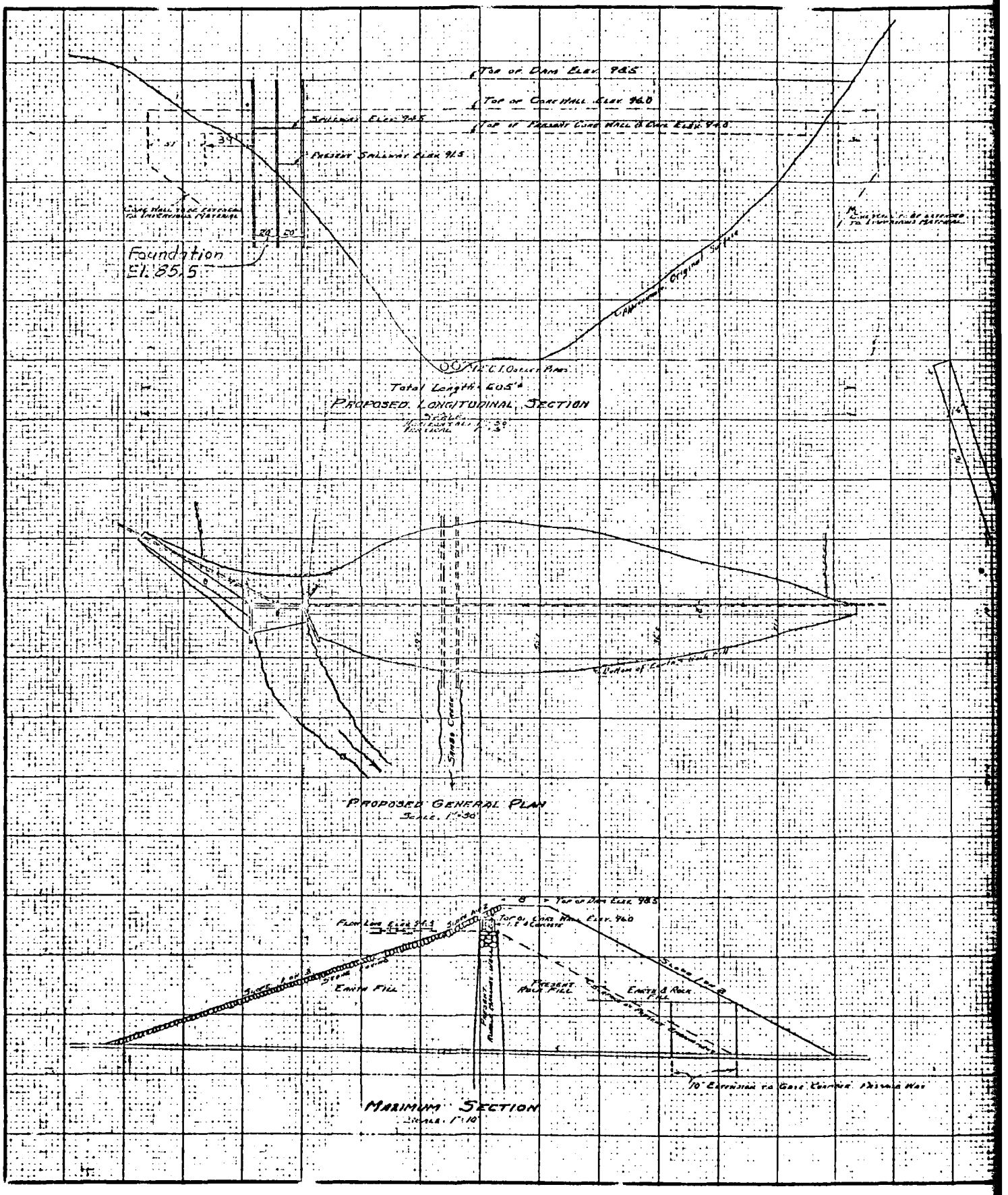
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

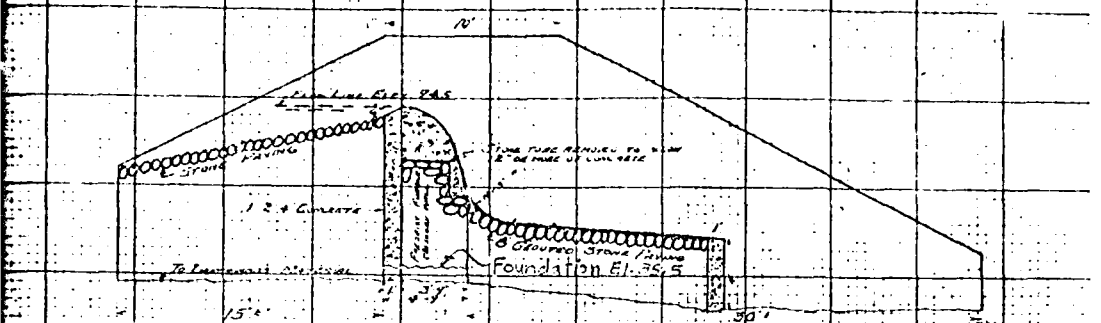
MIDDLE DAM

BOROUGH OF EAST STROUDSBURG

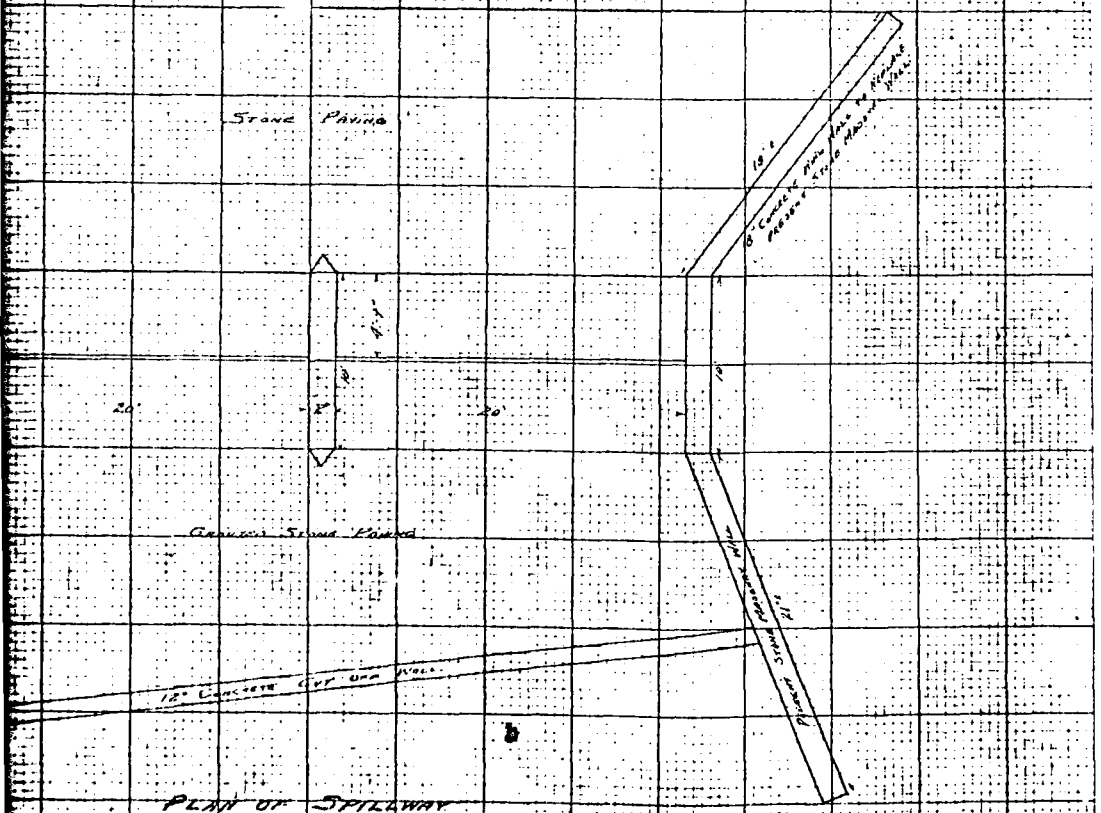
RESULTS OF AS-BUILT SURVEY (AUGUST 1930)

JANUARY 1980 PLATE E-4

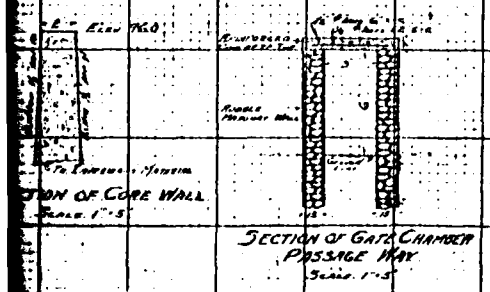

Top of Dam Elev. 985
Top of Core Wall Elev. 960
Spillway Elev. 945
Present Spillway Elev. 945
Foundation El. 85.5
20'
20'
Total Length 605'±
PROPOSED LONGITUDINAL SECTION
PROPOSED GENERAL PLAN
Scale 1"=30'
Top of Dam Elev. 985
Top of Core Wall Elev. 960
Flow Line Elev. 945
Stone Fill
Earth Fill
Present Rock Fill
Earth & Rock Fill
10' Extension to Base Existing Diversion Wall
MAXIMUM SECTION
Scale 1"=10'



PROPOSED SPILLWAY SECTION
SCALE 1"=5'



PLAN OF SPILLWAY
SCALE 1"=5'



SECTION OF GATE CHAMBER PASSAGE WAY
SCALE 1"=5'

REVISED
PLAN OF PROPOSED DAM REPAIRS
AT
EAST STROUDSBURG STORAGE RESERVOIR
ON
SAMBO CREEK, SMITHFIELD TOWNSHIP
MONROE COUNTY, PENNSYLVANIA

Scale 1 Inch = 1150 Ft.

Lloyd C. Hall, C.E.
Stroudsburg, Pa.

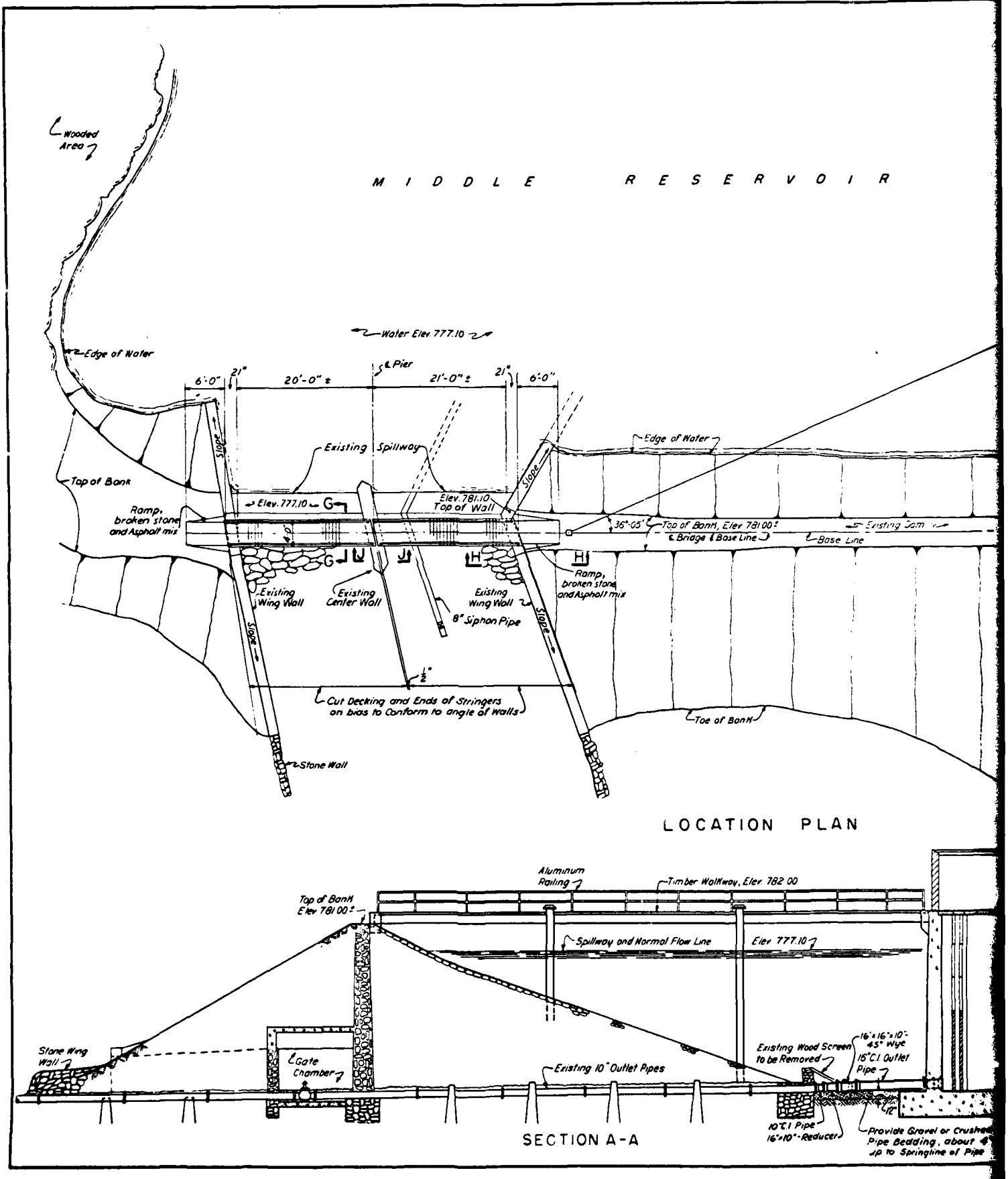
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

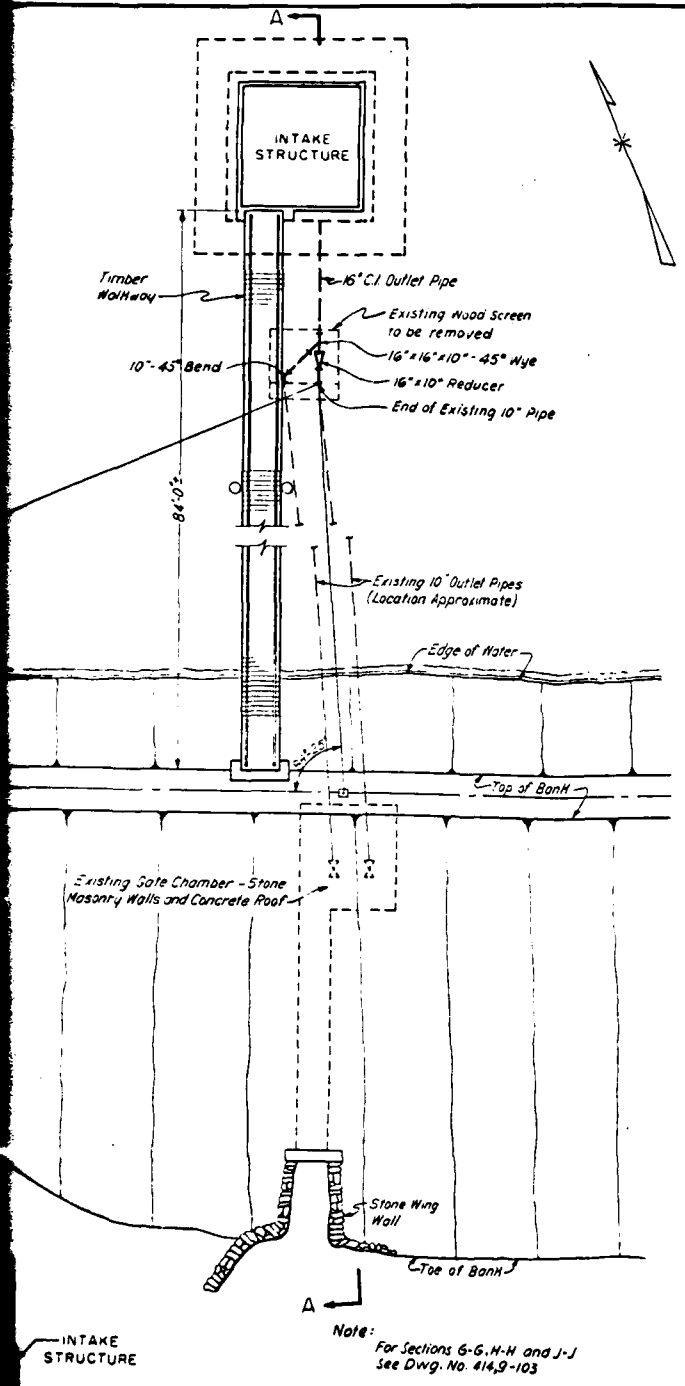
MIDDLE DAM

BOROUGH OF EAST STROUDSBURG

PROPOSED MODIFICATIONS
(1931)

JANUARY 1980 PLATE E-5


MIDDLE RESERVOIR
Wooded Area
Edge of Water
Water Elev. 777.10
℄ Pier
6'-0"
21"
20'-0" ±
21'-0" ±
21"
6'-0"
Slope
Existing Spillway
Edge of Water
Top of Bank
Elev. 777.10
G
Elev. 781.10
Top of Wall
Ramp, broken stone and Asphalt mix
36"-05"
Top of Bank, Elev. 781.00 ±
℄ Bridge ℄ Base Line
Existing Dam
Base Line
G
J
H
Ramp, broken stone and Asphalt mix
Existing Wing Wall
Existing Center Wall
8" Siphon Pipe
Existing Wing Wall
Slope
Slope
½"
Cut Decking and Ends of Stringers on bias to Conform to angle of Walls
Toe of Bank
Stone Wall
LOCATION PLAN
Aluminum Railing
Timber Walkway, Elev. 782.00
Top of Bank Elev. 781.00 ±
Spillway and Normal Flow Line
Elev. 777.10
Stone Wing Wall
℄ Gate Chamber
Existing 10" Outlet Pipes
Existing Wood Screen to be Removed
16"x16"x10"-45° Wye
16" C.I. Outlet Pipe
12"
10" C.I. Pipe
16"x10"-Reducer
Provide Gravel or Crushed Pipe Bedding, about 4" up to Springline of Pipe
SECTION A-A



Note: For Sections G-G, H-H and J-J See Dwg. No. 414,9-103

DRAWING NO. 414 9-101

BOROUGH OF EAST STROUDSBURG
MONROE COUNTY, PENNSYLVANIA

MIDDLE RESERVOIR INTAKE STRUCTURE

LOCATION PLAN AND SECTION

Buck, Seifert and Jost
Consulting Engineers
New York 3, N.Y.

Scale 1"=10'-0" October, 1962

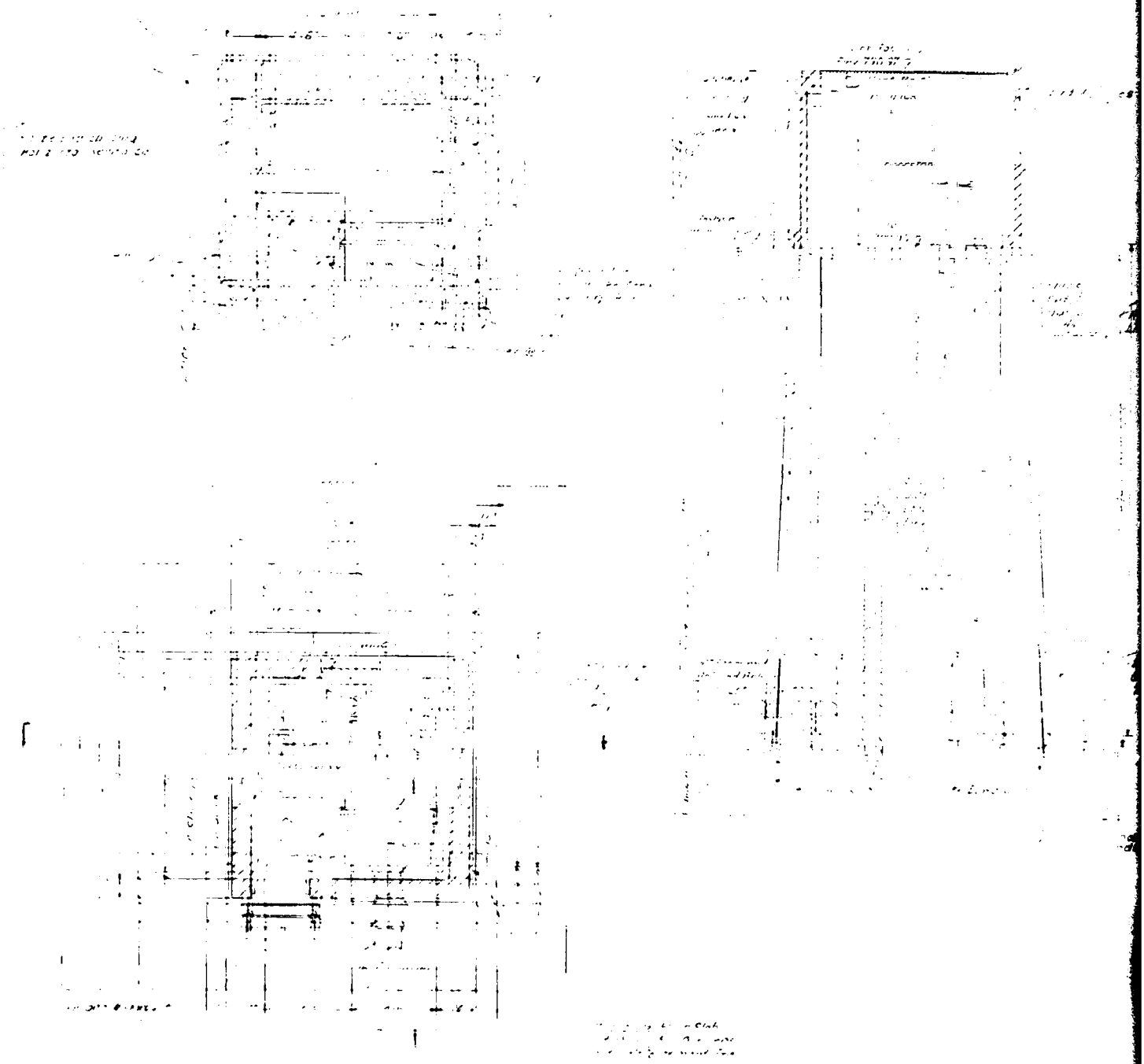
Drawn by: S.V.	Traced by: S.V.	Checked by M.E.	Examined by DP	Approved by
Revisions:				

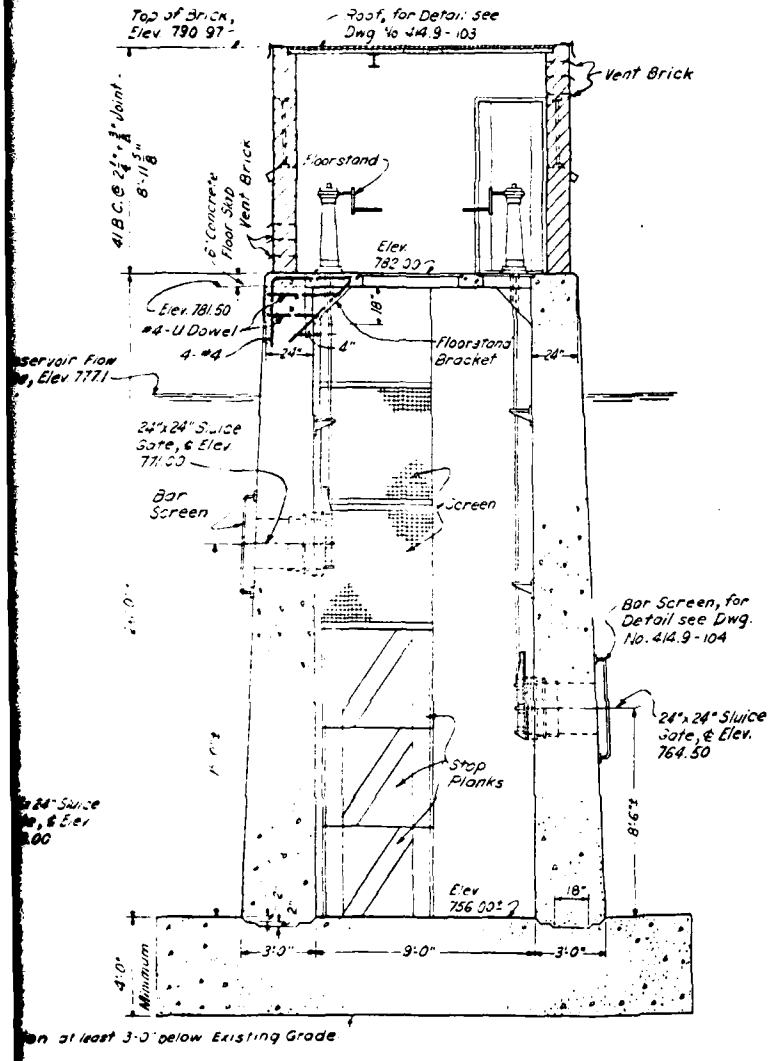
PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MIDDLE DAM
BOROUGH OF EAST STROUDSBURG

INTAKE STRUCTURE (1964)

JANUARY 1980 PLATE E-6





SECTION B-B

DRAWING NO 414 9-102

BOROUGH OF EAST STROUDSBURG
MONROE COUNTY, PENNSYLVANIA

MIDDLE RESERVOIR INTAKE STRUCTURE

PLANS AND SECTIONS

Buck, Seifert and Jost
Consulting Engineers
New York 3, N.Y.

Scale: 1/4"=1'-0" October, 1962

Drawn by R.J.U.	Traced by R.J.U.	Checked by M.E.	Examined by	Approved by
Revisions.				

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MIDDLE DAM

BOROUGH OF EAST STROUDSBURG

INTAKE STRUCTURE (1964)

JANUARY 1980 PLATE E-7

APPENDIX F

GEOLOGY

AD-A081 637 GANNETT FLEMING CORDDRY AND CARPENTER INC HARRISBURG PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM. MIDDLE DAM (NDI-ID-PA-00256) (--ETC(U)
JAN 80 DACW31-80-C-0017

UNCLASSIFIED NL

2 OF 2
AD
A081637

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DATE FILMED
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MIDDLE DAM

APPENDIX F

GEOLOGY

Middle Dam is located in Monroe County in the Appalachian Plateau Physiographic Province. The most pronounced topographic feature in the area is Camelback Mountain, which is a part of the Pocono Escarpment. The greatest relief along the escarpment is 1,000 feet, which occurs at Camelback Mountain. Streams east of the escarpment drain directly into the Delaware River, while those to the west drain to the Lehigh River. The Pocono Plateau section lies to the west of the escarpment. The Glaciated Low Plateau section is east of the escarpment, and is characterized primarily by preglacial erosional topography with locally-thick, glacial deposits. Generally, local relief is 100 to 300 feet.

Middle Dam is located within the Glaciated Low Plateau Section. Bedrock units of the Section include siltstones of the Mahantango Formation, siltstones and shales of the Trimmers Rock Formation, and seven mapped members of the Catskill Formation. These members include sandstones, siltstones, and shales of the Towamensing Member; sandstone, siltstone, and shale of the Walcksville Member; sandstones, siltstones, and shale of the Beaverdam Run Member; sandstone and shale in the Long Run Member; sandstones and conglomerates in the Packerton Member; sandstones and some conglomerates in the Poplar Gap Member; and sandstones and conglomerates in the Duncannon Member.

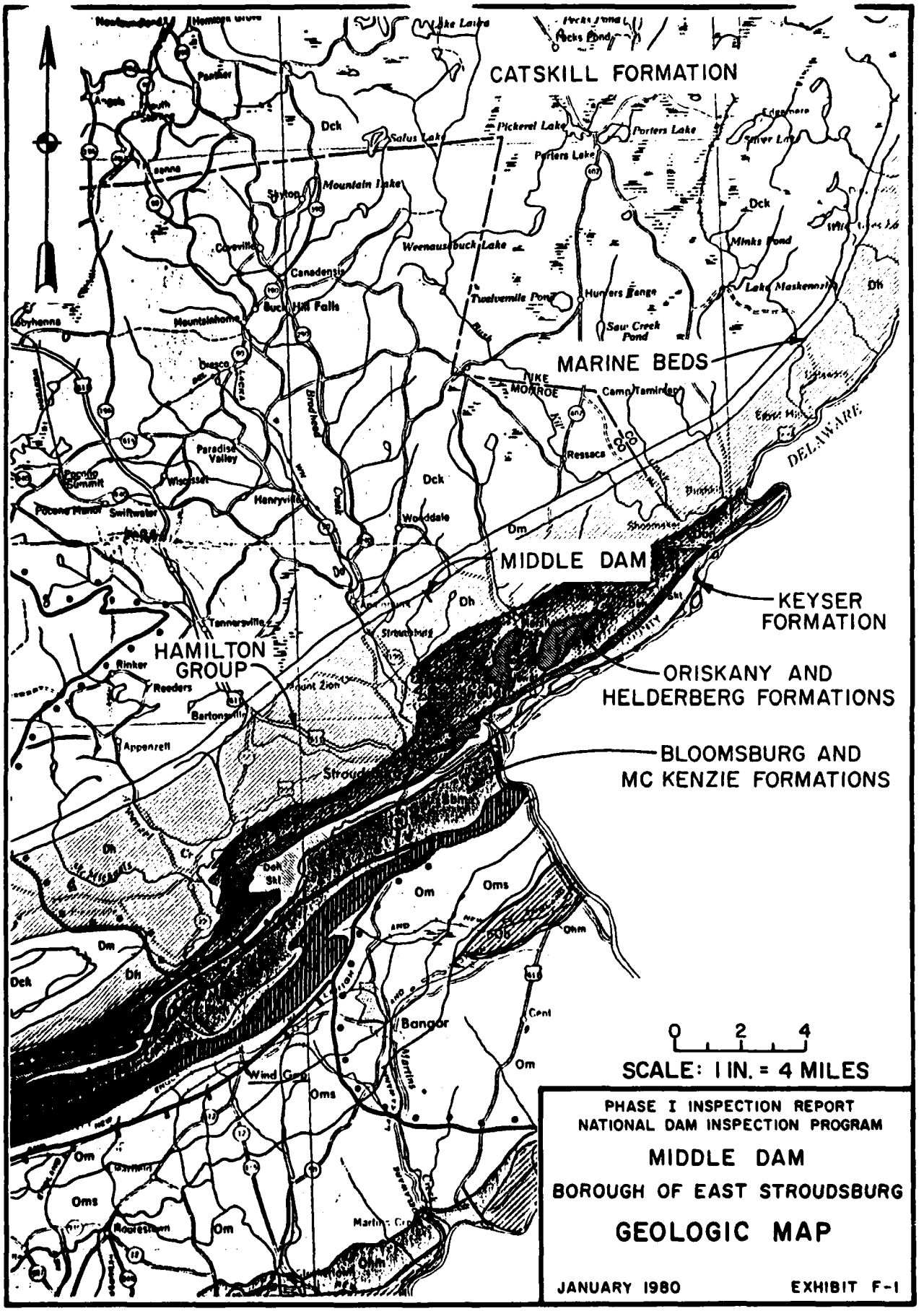
Middle Dam is underlain by the Mahantango Formation. The Mahantango Formation is primarily siltstone or silty shale. Bedding is generally thin to medium and well-developed. Primary porosity is low, but secondary porosity due to cleavage can be significant.

The rocks of the Mahantango Formation are reported to maintain high-angle slopes, but when excavated parallel to cleavage strike, they are susceptible to rockfalls.

Bedrock is entirely overlain by glacial till of late Wisconsin Age. This till is primarily an unsorted mixture of clay, silt, sand, and gravel. It is moderately cohesive and is generally derived from the local sandstones of the Catskill Formation. The till in this area averages 15 feet in thickness, with variations

ranging from 3 to 48 feet. The thickness is generally controlled by the bedrock topography with maximum thickness occuring in bedrock depressions and valleys.

The available records indicate that Middle Dam is entirely founded on the glacial till. Construction progress reports describe the corewall foundation material as blue clay and blue hardpan with occasional small pockets or streaks of gravel. The depth to bedrock is not known.



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

MIDDLE DAM

BOROUGH OF EAST STROUDSBURG

GEOLOGIC MAP

JANUARY 1980 EXHIBIT F-1